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Regis University
College for Professional Studies Graduate Programs
Final Project/Thesis

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DATABASE CONCEPTS IN A VIRTUAL WORLD

SUBMITTED ON OCTOBER 24, 2010

TO THE DEPARTMENT OF INFORMATION SYSTEMS

OF THE SCHOOL OF COMPUTER & INFORMATION SCIENCES

OF REGIS UNIVERSITY

IN PARTIAL FULFILLMENT OF THE REQUIREMENTS OF MASTER OF SCIENCE IN

DATABASE TECHNOLOGY

BY

Janet L. Ochs

APPROVALS

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Abstract

This project explored the use of a 3-D virtual world in an introductory database course to reduce the amount of time required to learn database concepts. A Second Life 3-D model was built to clarify database concepts and students used the model to create a Microsoft Access inventory database. Thereafter, the students provided feedback by answering a voluntary survey. Eighty two percent of the students surveyed agreed that the 3-D model clarified terms such as records, tables, primary keys and relationships. Seventy five percent of the students believed that the model reduced the amount of time required to learn these concepts.

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Chapter 1 – Problem Identification

Section 1.1 – Statement of Problem

The database curriculum for the Masters of Science in Computer Information Technology (MSCIT) at Regis University is extensive and rigorous. For students majoring in the database concentration, Regis University offers classes in Database Architecture, Database Concepts, Oracle Database Administration, Backup and Recovery, Performance Tuning, PL/SQL Programming, XML, Middleware Architecture and more. Based on today's job postings, however, one realizes that the aforementioned topics are only cursory in comparison to the knowledge required for a seasoned database professional. In addition, classes for newer database topics such as mobile applications, cloud computing, data warehousing and data mining are either unavailable at Regis or are too difficult to complete within the allotted 36 credit hours. Therefore, new instructional tools are needed to provide faster ways to learn the material offered in database courses. This way, students can explore topics in greater detail or investigate new topics such as cloud computing with the extra time gained.

Bagui and Ter Harr (2009) agree that the complexity of today's database technology creates new challenges for database educators. The authors (2009) explain that educators "have to cover not only a lot more database topics, but also cover them in greater depth and breath, and since we are limited to 120 hours of curriculum space, we have to come up with new ways of offering the database courses." Murray and Guimaraes (2008) claim "one solution to addressing this dilemma resides in the development of instructional support materials". As part of an NSF grant, Murray and Guimaraes (2008) created a series of database courseware animations for use as instructional tools and received positive results.

Today, educators are creating instructional tools using Second Life to create 3-D virtual worlds for learning. Although the Second Life Education wiki (2009) claims Second Life is used by more than 100 educational institutions, the tool has not been used within a Master's of Science program with a database concentration. Since the database curriculum needs to be updated regularly and new topics need to be added continuously, instructional tools such as Second Life can provide more efficient ways to deliver more education within a limited time period. If Second Life can be used to decrease the amount of time required to teach database concepts, the additional time can be used to cover more database topics. The use of a 3-D virtual world in a database course can reduce the amount of time required to learn core database concepts. Thus, the paper is entitled "Database Concepts in a Virtual World".

Section 1.2 - Significance of Study

Much has been written on the issues surrounding the database curriculum and the seemingly endless array of topics for inclusion. To resolve this issue, the majority of authors propose increasing the number of database related courses and the time required to learn the material. However, only one set of authors has suggested using an instructional tool to improve the efficiency of content delivery. This paper adds to the body of knowledge because it proposes the use of a different tool, Second Life, to increase the speed with which students can learn database concepts. This paper asserts the following:

Instructional tools such as Second Life can be used to reduce the amount of time required to learn database concepts and thus free up time to add new subject areas.

If the assertion proves true, the prototype from this study can be used as a model for future database learning modules and can positively influence the productivity of students in

database courses long term. Otherwise, the current situation will remain the same as new topic areas are added to the database field. As noted in the *Claremont Report for Database Research*, exciting new areas such as “big data”, “data analysis as a profit center”, “architectural shifts in computing”, mobile applications, “cloud data services” and virtual worlds are now being brought to the forefront. The question is - can the educational community keep pace with these rapid changes by finding new and innovative ways of delivering database course content?

Chapter 2 – Literature Review

Section 2.1 – Literature Review Introduction

This paper will review literature involving the status of computing curriculum and will identify problem areas relating to database education. This paper will also explore documented uses of instructional technology for database education and the use of Second life for learning. The purpose of reviewing the database curriculum is to determine if it is under stress and whether or not tools such as Second Life can be used to help alleviate the problem. The literature review hopes to provide insight on the following questions:

1. Can Second Life be used to create 3-D virtual environments that teach database concepts such as entities, records and relationships?
2. Can these 3-D models be used to improve the efficiency of content delivery and increase student understanding?

Section 2.2 – Literature Review

The Joint Task Force for Computing Curricula (2005) explains that it is difficult to update computing programs for students because the field changes so rapidly. In addition, the Joint Task Force (2005) claims that educational institutions are slow to act and fail to make program changes quickly. Other authors such as Adams, Granger, Goelman and Ricardo (2004), Wagner (2005) and Murray and Guimaraes (2008) also support the assertion that computer programs for databases are constantly evolving and the amount of time to cover relevant topics is limited. However, Bagui and Ter Harr (2009) provide the most comprehensive review of both the history of the database curriculum and its current status. In their article, the authors review what other colleagues are doing and survey industry experts to document industry requirements. The authors (2009) summarize “two major model curricula, IS2002 and the ACM/IEEE

CC2005" in two separate tables. Next, Bagui and Ter Harr (2009) map the model curricula to actual courses as indicated below.

Topic Areas (as identified by industry experts)	**Maps to Course**	**Corresponding IS 2002 Database Topics**	**Corresponding Database Performance Capabilities covered (from ACM/IEEE CC2005)**
Relational Model, ER Model, Relational Algebra, Relational Calculus, SQL, DDL, DML, Views, Query by Example, Normalization, PLSQL, Triggers	**Database Systems**	- Conceptual, logical, physical data models and modeling tools -Models for databases; relational -Design Tools -Data Dictionaries -Database Implementation	-Design a database system -Model and design a database -Implement information retrieval software
Logical Query Language, Transaction Processing and Management, Query Processing & Optimization, Concurrency	**Advanced Database Systems**	-Data Dictionaries -Multi-tier planning and implementation	
Backup and Recovery Techniques, Database Administration, Physical Design & Tuning, File Systems, Disk Storage & Indexing	**Database Administration**	-Data Conversion and post implementation review	-Select database products -Configure database products -Manage databases
Object-Relational Databases	**Object-oriented databases** (to be created later)	-Structured and object design approaches -Models for databases; object oriented	
XML databases	**Web Databases** (to be created later)		
Data Warehousing	**Data Warehousing** (to be created later)	Data repositories; warehousing	
Data Mining	**Data Mining**	Data Mining	

Figure 1 - Topics mapped to courses and IS2 002 topic areas and CC20005 database performance capabilities Source: Bagui and Ter Harr (2009)

As displayed in the preceding table, Bagui and Ter Harr (2009) propose adding new courses to the database curriculum to address the growing problem of too much material to cover in too short of a time span. Bagui and Ter Harr (2009) propose repackaging database courses by

offering database certificates and suggest looking at new degree programs for the database area. Murray and Guimaraes (2008) concur with the notion that new database topics must be covered in the database curriculum. However, Murray and Guimaraes (2008) added the idea that instructional tools might be used to supplement the core curricula. The authors (2008) write

> "While a set of commonly identified core concepts and principles exists, there is little consensus on what supplemental materials should be included in database courses. Through an NSF proof-of-concept grant, we designed and developed courseware incorporating the use of animations to deepen and enrich standard presentations of core database concepts and to complement database teachings as found in the most popular texts. This paper proposes extending that model to modules of relevant and advanced database topics. Modules covered include data warehousing, data exchange via XML, database security and database system architecture, performance and tuning. Students in the computing disciplines must develop a strong knowledge base and build a firm foundation in core database concepts and principles. They must also extend this to supplemental and advanced topics. The dilemma for CS educators is to find avenues through which these topics can be explored in an efficient and effective manner".

As Murray and Guimaraes (2008) point out, perhaps there are more efficient ways to explore database topics. One such way, as suggested in this paper, is to use 3-D virtual environments such as Second Life.

Second Life contains a large user base and has been used for teaching for a number of years. Gollub (2007) claims there are 4 million registered users for Second Life and the most common educational use for Second Life is teaching classes and building libraries. For example, Gollub (2007) explains that "to teach a class in the virtual Second Life world, referred to as inworld", faculty are "renting or buying spaces, buying or building models of the subject they intend to teach, and inviting the class to meet partially or entirely in Second Life." Furthermore, Gollub (2007) asserts that certain faculty members are "encouraging their students to explore Second Life and interview other residents about their experiences." Finally, Gollub (2007) writes that a few students are "developing thesis material from specific aspects of the environment". Gollub (2007) describes some of the advantages of Second Life and claims a "professor can illustrate points visually as well as verbally with minimum effort. For instance, Gollub (2007) explains that a chemistry professor can animate an electron and a history professor can simulate a "discussion with a fictional or historical personage."

Not all researchers find Second Life advantageous to learning. Clavering and Nicols (2007) experienced some difficulty working with Second Life. The authors claim the system lacked documentation and enforced strict limits on resources such as memory. Clavering and Nicols (2007) also found implementing the system while learning the software to be challenging and experienced slow response times from some of the library functions. In addition, many of the ideas the authors had for instruction proved to be difficult to implement. For instance, Clavering and Nicols (2007) discovered that "interactive 3D models of Newton's laws of motion are difficult to implement well because of the lack of control of how objects are viewed." As a result, Clavering and Nicols (2007) believe "the range of truly worthwhile educational applications of Second Life remains an open question."

On the other hand, Ritzema and Harris (2008) also experienced some difficulties with Second Life, but maintained an overall positive outlook on the Second Life experience. Ritzema and Harris (2008) warn that "the amount of preparation time in setting up user accounts, in-world property, objects, and videos can be substantial." To avoid this problem, the authors recommend purchasing prefabricated "buildings and objects from vendors within Second Life. Ritzema and Harris (2008) explain that information can be learned from stock objects by reading the existing scripts (much like reading html for a web page). Despite some difficulties with preparing the learning environment, the authors found that 83% of their computer science students wanted to see an increase in Second Life usage. Based on student surveys, Ritzema and Harris (2008) determined that 76.5% of the computer science students ranked the Second Life user interface as a "three or less in terms of usability" (on a scale of 1 to 5 - with 1 being the easiest).

Jeffers (2008) from the University of Delaware documents several considerations for using 3-D environments in Second Life. Jeffers (2008) explains that there is a learning curve for working with the new software and time is required for figuring out the navigation features of Second Life. Jeffers (2008) recommends 40 hours of upfront training time and suggests being realistic about "those blazing the trail for your institution." Nonetheless, Jeffers (2008) encourages faculty to try Second Life and lists numerous examples of various "Islands" used for learning projects including:

- "A giant cell that you can move inside of and explore its parts on Genome Island (Genetic Atelier Genome, http://slurl.com/secondlife/Genome/115/108/27)".
- "The Virtual Hallucinations sim, where schizophrenia is explored in a building with interactive visuals and 189 voices based on real life patients' schizophrenia experiences. The site

comes with a warning that its contents may be disturbing for some people (Virtual Hallucinations UC Davis, http://slurl.com/secondlife/Sedig/28/45/22)".

- "NOAA offers a number of simulations and learning modules that show the effects of global warming, tsunamis, & oil spills(NOAA, http://slurl.com/secondlife/Meteora/165/121/27)"

Jeffers (2008) concludes her article by stating "we are extremely pleased with the development of our Islands and with the enthusiasm our early adopter faculty has shown embracing this new learning environment". Jeffers (2008) continues to say "when the technology is a good match for a course, we are encouraging more faculty members to give this virtual world a try."

Based on Jeffers (2008) comments regarding courses being "a good match" and the words of caution from other experienced faculty members such as Clavering and Nicols (2007) or Ritzema and Harris (2008), careful consideration and planning must go into using Second Life for a course. However, the Second Life website lists over one hundred completed projects for education. Although none of the projects listed are related to databases and this project might be charting new territory, the success of early adopters and their positive results makes it worth the risk of trying the 3-D medium. This appears to be especially true if the project development is supported by considerable training and a certain degree of patience.

Section 2.3 – Literature Review Conclusion

This investigation reviewed literature involving the status of college level computing curriculum and identified problem areas relating to database education. One issue identified by numerous authors related to the increasing number of database topics recommended by industry and professional organizations. Unfortunately, as additional topics are required, credit hours are

not necessarily added to the college program. As a result, researchers proposed increasing the number of courses within the computer science curriculum or creating database certificates or separate database degree programs. Papers by Murray and Guimaraes (2008) agreed with this approach, but also introduced the idea of using instructional tools to provide more efficient ways to deliver course content.

This investigation also reviewed literature pertaining to Second Life in an educational setting. While there is not unanimous agreement on the validity of using Second Life for education, there are numerous examples of Second Life implementations in the educational field including the University of Delaware's Island and the 100 plus projects listed on the Second Life wiki. Based on articles read, it appears that Second Life is appropriate for creating models of database concepts as long as proper training is in place and a valid project timeline is established. As far as the 3-D model providing a faster way to learn about database concepts, this is yet to be determined as the literature review did locate any material related to this assertion.

Chapter 3 – Methodology

Section 3.1 – Research Design/Methodology Overview

A qualitative and constructivist approach was used for this research project. A prototype was developed using Second Life and a classroom case study was devised. In the prototype, 3-D representations of items were created to teach students about database concepts such as entities and relationships. After viewing the prototype, students used the 3-D images to create an inventory database in Microsoft Access using fields, records, data types, tables, keys and relationships. Students also learned about database concepts using traditional teaching methods. Once the students utilized both methods, feedback was gathered through student comments and an online survey.

Section 3.2 – Location of study

The computer classrooms were located at a community college in upstate NY. The name of the class was Introduction to Databases and the software required was Microsoft Access. The class contained a lecture format (usually 45 minutes to 1 hour) and was followed by a lab component (50 to 65 minutes).

Introduction to Databases is typically taught in five week sections and is usually taken after students complete a five week section of Introduction to Word Processing and another five week section of Introduction to Spreadsheets. The three five week sections usually transfer as one unit to a four year college as CS 101.

Section 3.3 - Participants

Forty two community college students enrolled in computer application courses (CAPS). Computer application courses at the community college are typically taken by non-computer

science majors. For example, CAPS students are general studies, criminal justice, sports management, construction technology, human service, business or accounting majors.

Section 3.4 - Materials

Materials used in this project included Second Life Software (Second Life Viewer 2), training materials/documentation, two computer classrooms (with twenty four student PCs and one instructor PC in each room), projection screens and associated equipment, internet access, web based student instructions and worksheets, removable disks and online student surveys.

Section 3.5 - Procedure – Steps to conduct study

Obtained permission from community college Dean of Instruction to conduct the study and utilize resources. Strategized with the community college Instructional Software Specialist. Specialist recommended installing Second Life on instructor PC only. This way, the instructor could control the movement of the avatar and simply display the Second Life 3-D environment on the projection screen for students to observe. The specialist suggested this approach would reduce student training time and the complexity of the entire project.

Scheduled meeting with Dean of Campus Technology to discuss project. The dean identified possible pitfalls of running Second Life in the computer labs. For example, the Dean discussed overloading the college network with Second Life 3-D traffic. As a result, the original implementation plan was modified based on suggestions from Campus Technology. Second Life was run from the instructor PC only and displayed on the projection screen for the students to view and analyze.

Started to review Second Life You Tube videos, website and wiki information. Purchased and read Second Life book on operational aspects of the product. Loaded and accessed the

Second Life software (Second Life Viewer 2) on home computer. Experimented with Second Life using a basic avatar and explored Second Life objects.

Created a second avatar named Database Engineer (female) and became familiar with Second Life features by visiting Welcome, Orientation, Help and Discovery Islands. Modified the avatar's appearance and learned how to manipulate objects in Second Life. For documentation regarding the detailed steps taken at the various islands, see Appendix A.

Researched different Second Life options for obtaining land and selected a premium addition of Second Life (SL) for $22.50 per quarter. The premium addition provides a plot of developed land and a pre-made house. Searched Second Life inventory and" in-world" locations for free objects to fill the house with furniture. Modified many of the objects by changing the size, color or features. Built some 3-D objects such as a wall for inside the house and purchased several pre-made objects at Second Life furniture stores. Utilized free Linden dollars (Second Life money) from the premium account and obtained some additional dollars by using a credit card to make furniture purchases. ($2000 Linden dollars = $7.99 US dollars) Documented the steps required to fill the house with furniture. For details, see documentation in Appendix B.

Created SL "Note cards" for furniture to hold information for database records such as the furniture description, price, item serial number and warranty information. Developed note cards to establish a scavenger hunt like activity for the students. The avatar clicked on the furniture to bring up the note cards.

Started teaching the students in the classroom and used traditional teaching methods such as lecture and hands on exercises. During the first lecture, students received information regarding database terms and concepts. In addition, students manipulated an existing Access database. In lab time, students utilized textbook exercises to modify the same database.

Conducted three additional classes using traditional teaching methods to manipulate or create databases.

Contacted campus technology to install Second Life software and tested the model at the community college. Explained and demonstrated the model to one class and asked students for feedback. Improved initial prototype based on student's recommendations. For instance, created web based instructions for using the prototype and developed online worksheets to assist students with the collection of data for the database. Also, added floating text inside the 3-D house to label the rooms. This was accomplished using Second Life scripts and made demonstrating the prototype easier. Once the initial prototype of the house was improved and completely finished, created a second avatar, Database Scientist (male), and a second home (DB Vacation Home). This added a second location, second avatar, more rooms and additional inventory to the model.

During one class lecture, demonstrated Second Life to students by using the following steps:

1. Displayed image of Second Life virtual home, DB Home, on the projection screen during class. Explained to the students that we would be using the contents of the house to build an Access inventory database. Also, the Avatar named Database Engineer would move through the home to help us collect data for the database. Asked students to access a link containing the instructions for collecting the data. For a copy of the instructions, see Appendix C.
2. After reviewing the instructions, students accessed an online spreadsheet to assist with the collection of data. The spreadsheet was saved to disk.
3. Moved the avatar through the house and clicked on the pieces of furniture to access "note cards". The note cards were displayed on the screen and contained the information for the

database records. The information was used to update the spreadsheets. Gave several students the opportunity to use the avatar from the instructor PC.

4. During this process, database terms such as records, fields, tables and relationships were reviewed and discussed.
5. Once data collection was completed, students began to create a database with two tables, furniture and rooms. Students related the furniture table to the room table using primary and foreign keys. The database was saved to disk and used again in the next class.

   For more detailed information on demonstrating the model and creating the first part of the database, please see the PowerPoint slides and images located in Appendix D.

During a second class lecture, utilized the Second Life model by using the following steps:

1. Displayed image of Second Life virtual home, DB Vacation Home, on the projection screen during class. Explained to the students that we would be using the contents of the second house to add to the existing inventory database. Also, the Avatar named Database Scientist would move through the home to help us collect data for the database. Asked students to access hyperlink containing the instructions for collecting data. For a copy of the instructions, see Appendix E.
2. After reviewing the instructions, students accessed an online spreadsheet to assist with the collection of data. The spreadsheet was saved to disk.
3. Moved the avatar through the house and clicked on the pieces of furniture to access “note cards”. The note cards were displayed on the screen and contained the information for the database records. The information was used to update the spreadsheets. Gave several

students the opportunity to use the avatar from the instructor computer. Discussed the implications of adding a second house and additional inventory to the database.

4. Once data collection was completed, students began to modify the inventory database created in the previous class. The furniture and room tables were updated with additional records. A third table, houses, was created using information in the student instructions. Students related the house table to the room table.

For more detailed information on using the second house and updating the database, please see the PowerPoint slides and images in Appendix F.

After conducting the two lectures, additional modifications were made to the model. Access database images were inserted inside the house and a hyperlink was added which contained one possible inventory database solution. For a copy of the solution, please see Appendix G.

On the last day of class, an online voluntary survey was provided for students that participated in the project. The survey results were tabulated and analyzed as indicated in the next section.

Chapter 4 – Results

Section 4.1 - Data Analysis

Forty two students used the Second Life 3-D environment to build a Microsoft Access database and to review database concepts. After using Second Life, students were asked to participate in a voluntary online survey. Out of forty two students, fourteen students did not participate in the survey. Therefore, twenty eight students provided feedback and comments.

After using the 3-D model, seventy nine percent of the respondents agreed it was easier to understand database concepts such as tables and relationships. In addition, seventy five percent believed the model reduced the amount of time required to learn about these concepts. Eighty two percent agreed that the model clarified concepts such as records, tables, primary keys and relationships. For a detailed breakdown of all the survey questions and responses, please see **Figure 2** – The Results of the Student Survey shown below.

1) **After viewing the 3-D model of furniture and rooms, it is easier for me to understand database concepts such as tables and relationships.**

	Percent	Number of Students
Strongly Agree	36%	10
Agree	43%	12
Neither Agree or Disagree	7%	2
Disagree	14%	4
Strongly Disagree	0%	0
	100%	28

2) **I believe the 3-D model can reduce the amount of time required for me to learn about database concepts.**

	Percent	Number of Students
Strongly Agree	43%	12
Agree	32%	9
Neither Agree or Disagree	14%	4

Disagree	11%	3
Strongly Disagree	0%	0
	100%	28

3) **I prefer to learn about database concepts using the traditional teaching methods (NOT the 3-D model).**

	Percent	Number of Students
Strongly Agree	4%	1
Agree	25%	7
Neither Agree or Disagree	32%	9
Disagree	18%	5
Strongly Disagree	21%	6
	100%	28

4) **I prefer to learn about database concepts using the 3-D model**

	Percent	Number of Students
Strongly Agree	43%	12
Agree	21%	6
Neither Agree or Disagree	25%	7
Disagree	7%	2
Strongly Disagree	4%	1
	100%	28

5) **The 3-D model helps to clarify terms such as records, tables, primary keys and relationships**

	Percent	Number of Students
Strongly Agree	36%	10
Agree	46%	13
Neither Agree or Disagree	7%	2
Disagree	7%	2
Strongly Disagree	4%	1
	100%	28

6) **I think it would be faster for me to learn the material using 3-D models rather than the textbook.**

	Percent	Number of Students
Strongly Agree	25%	7

Agree	36%	10
Neither Agree or Disagree	29%	8
Disagree	7%	2
Strongly Disagree	4%	1
	100%	28

7) **For completing lab assignments, I would prefer to use exercises involving the 3-D model rather than the textbook.**

	Percent	Number of Students
Strongly Agree	29%	8
Agree	39%	11
Neither Agree or Disagree	11%	3
Disagree	14%	4
Strongly Disagree	7%	2
	100%	28

8) **The 3-D representation of an inventory database improved my understanding of the material.**

	Percent	Number of Students
Strongly Agree	36%	10
Agree	36%	10
Neither Agree or Disagree	18%	5
Disagree	7%	2
Strongly Disagree	4%	1
	100%	28

Figure 2 – The Results of the Student Survey

As part of the survey, students were asked to answer the question "What did you like or dislike about the model?" These comments have been grouped into positive, neutral and negative comments as follows:

Positive Comments

1 The 3D model brings the concepts "alive".

2 I liked the 3D because it was more interactive and made learning databases more entertaining and enjoyable

3	It was cool that we could see all that was in the house.
4	That it brings entertainment to learning the material
5	I liked that it showed a visual of the relationships of items
6	I like it because it is easier to understand
7	I liked the virtual reality. It added a new and fun way to look at how a database works in the real world
8	The 3-D is much easier to understand the material with animated guides it just is easier to understand
9	The 3-D model helped make the concepts easier to understand
10	I'm more of a visual person rather than just reading something out of a textbook. The 3-D model really caught my attention so it made it easier for me to learn.
11	Helps in giving a visual on the concepts
12	It gave me a more hands on approach to learning about databases
13	I was just a little concerned with my lack of familiarity with using an avatar, but it seems simple enough - and quite fun.
14	I liked the fact it showed a lot of information on the model, I think it could work for most people like myself
15	I liked it because I am a visual learner and it helped
16	I believe that I would have gotten a much better grade if I had used the 3D model from the start. Using the model showed me how the data relate to the datasheet. I hope that I will be able to utilize this creative learning experience in the future.
17	I liked that it was 3-D. It made it easier to understand.
18	I liked that the model helped explain and helped me understand the database. But it seemed to take a lot of time and for me. I don’t think using this to do the lab assignments would be helpful.
19	I like this type of learning better because I can see the relationships better
20	It is an easier way to learn

21	It made it easier to see and understand what the material was all about.
	Neutral comments from students that found the model made no difference
22	It was cool but I already understood the concepts from the text
23	It did not make much of a learning difference for me
	Negative comments from students that did not like the 3D Model, found it complicated or confusing
24	It was more complicated.
25	I thought the 3-D model was confusing.
26	I just did not like it.
27	Did not fully understand the 3D model and how it can be applied to database rather than using the textbook. Fun to watch and possibly participate. Not sure about the concept of using it in place of the textbook. Textbook not all that helpful either.
28	I thought it was a pretty neat 3-D model for fun, but I thought it was also confusing at the same time.

After the completion of the survey, the following unsolicited comment was received in an e-mail from an older adult student.

> **Sent:** Wednesday, May 05, 2010 7:20 PM
> **To:** Janet Ochs
>
> Hi,
>
> I just wanted to take the opportunity to let you know a couple of things.
> First, you are a great example of what teachers should be.
> The games, web-site, and 3D images of the houses have been a great help to me personally, and I commend you for your enthusiasm and imagination in making a course understandable and fun. It is so refreshing to **not** have to rely on a textbook for learning the lessons.
> Second, if there is any way I can help you "sell" this kind of innovative way of teaching, please feel free to have people ask me about it.
> It has been a pleasure being in your class, and meeting you.

Section 4.2 - Data Summary

Seventy nine percent of the survey respondents agreed it was easier to understand database concepts such as tables and relationships after using the model. In addition, seventy five percent believed the model reduced the amount of time required to learn about these concepts. Sixty four percent of the students preferred to learn about database concepts using the model rather than traditional teaching methods. Sixty one percent believed it would be faster to learn the material using the model rather than the text book (twenty nine percent neither agreed nor disagreed). For lab exercises, sixty eight percent of the students wanted to use the model rather than the assignments from the book. Finally, eighty two percent agreed that the model clarified concepts such as records, tables, primary keys and relationships.

Chapter 5 – Project History

5.1 Project Origins

After drawing many entity relationship diagrams with boxes and lines, the author of this paper wondered whether or not a better tool existed. Why couldn't entity relationship diagrams be drawn in 3-D? This way, a visual could be developed to actually "see" the relationships between the entities. Furthermore, most databases were created using descriptive text containing user requirements which were difficult to translate into a physical database. Why not use images or a visual of what the user wanted instead?

After researching 3-D software, Second Life was chosen by the author based on the number of colleges using Second Life for education. Subsequent to some experimentation with Second Life, the author believed a model could be built to explain database concepts. In addition, the author thought the model could be used by students to create a database. Finally, the author surmised that it would be easier and faster to create the database using a visual, rather than text.

5.2 Scope

In the primary research, a Second Life 3-D model was created for use in an Introduction to Database course. The model was used by the instructor to clarify database concepts and used by students to create an Access inventory database. After using the model, students answered a voluntary survey to provide feedback. The deliverables for the project included the Second Life model, the student created inventory database and the survey results.

5.3 Project Management

The project was managed by the author of this thesis and took place at a community college. Input and suggestions were obtained from the Dean of Campus Technology and the

Instructional Software Specialist located at the community college. Steps in the project implementation plan included the following:

1. Contact local education technology support persons at the community college and request assistance by 1/15
2. Obtain Second Life book on operational aspects of the product by 1/15
3. Obtain permission from employers to conduct the study and/or utilize resources by 1/25
4. Identify sources for Second Life training – classes, seminars, You tube videos, Second Life website/wikis or other resources by 1/29
5. Identify free source of Second Life "land" to create learning environment by 2/1
6. Complete Second Life Training by 2/26
7. Receive permission from campus technology to load Second Life on instructor computer and install the software by 3/5
8. Create Second Life initial learning environment/prototype for database concepts (utilize home computer and classroom computer) by 3/31
9. Test the environment with several students and improve as required from 4/1 to 4/8
10. Create student survey, coordinate with Director of Institutional Research by 4/16
11. Utilize Second Life in classroom and record student observations from 4/8 to 4/23
12. Conduct student survey from 4/26 to 4/30
13. Tabulate survey results by 4/30

5.4 Milestones

Major milestones in the project included the following:

- Learning Second Life on home computer, creating an avatar, experimenting and developing objects - 1/29 - 4/26

- Installing the Second Life Software at the community college – 3/10
- Obtaining premium accounts in Second Life to create two avatars and the final 3-D model – 4/17- 4/19
- Creating the objects for the final model and writing scripts – 4/17- 4/25
- Demonstrating the model to a small group of students for feedback - 4/23
- Making changes to the model (based on student feedback) to increase effectiveness - 4/23 to 4/25
- Demonstrating and using the model in classes – 4/23, 4/26, 4/28, 4/30
- Creating the Access inventory database - 4/23, 4/26, 4/28, 4/30
- Developing the survey – 4/4 – 4/16
- Conducting the survey – 5/3 – 5/7

5.5 Changes to the Plan

The initial plan called for Second Life software to be installed on two instructor machines and forty eight student computers in two different classrooms. Originally, the plan called for ten to twenty students per class accessing the Second Life model with their own avatars via the campus network. Instead, Second Life was installed on the instructor PC and demonstrated to the class on the projection screen. Students could see the model, however, one avatar was used at a time and the instructor or an individual student moved the avatar through the 3-D environment for the class to observe. The change was made based on recommendations from the community college Instructional Software Specialist and the Dean of Campus technology. Both argued this approach would greatly reduce the complexity of the project and eliminate the heavy strain on the campus network.

The 3-D model was also changed based on the Second Life land selection. At first, a model of a company was going to be built on free Second Life land obtained from a technical support organization. The company 3-D model was going to contain company buildings with various products located in inventory. The company model was going to be used to create an inventory database containing product related data. Due to some administrative concerns and project time constraints, another land choice was made. Two Second Life premium accounts were purchased. These accounts came with pre-designed land and readymade buildings in the form of houses. By using the premium accounts' land and houses, many hours required to build the Second Life environment were saved. In addition, the land and houses were used in the 3-D model and an Access inventory database was developed for furniture inventory (as opposed to a company product inventory database).

5.6 Evaluation

The project was completed on time and followed the initial schedule with minor adjustments. A 3-D model was built in Second Life to demonstrate database concepts and the students used the model to create an Access inventory database. After using the 3-D model, seventy nine percent of the respondents agreed it was easier to understand database concepts such as tables and relationships. In addition, seventy five percent believed the model reduced the amount of time required to learn about these concepts. Eighty two percent agreed that the model clarified terms such as records, tables, primary keys and relationships.

5.7 Summary

Second Life was used to create a 3-D environment to explain database terminology and concepts. Even though some flexibility was required and several changes had to be made to the original implementation plan, Second Life was still used to construct a viable 3-D prototype.

Decisions to change the original plan resulted in a positive outcome. Heavy network traffic and additional student training was avoided by using avatars at the instructor PC only and projecting the 3-D model on the projection screen. By using two avatars and two premium accounts with pre-built houses, the complexity of the project was decreased, building time was saved, and the project was successfully completed within the allotted time period.

For the majority of students, the Second Life model reduced the amount of time to learn about database concepts. However, the exact amount of time saved is not known and not all students thought the Second Life model was helpful. In fact, eleven percent of the students found the model to be confusing. As a result, the underlying cause for this confusion needs to be examined and warrants further investigation.

5.8 Future Areas of Investigation

In the project, students learned about database concepts using the traditional lecture method and the 3-D model. Although the majority of students believed the 3-D model reduced the amount of time to learn about database concepts, the amount of time saved was not quantified. To determine how much time is actually saved, a second project needs to be completed using two different classes for comparison purposes. Ideally, one class would use the traditional method to learn about database concepts and a second class would use the 3-D model exclusively. This way, the classes could be compared to determine how much time is gained by using the model. Also, more questions need to be asked to discover the source of confusion for some students using the model. Perhaps, the model is not appropriate for all learning styles or maybe the model needs additional changes to enhance student understanding. Each of these areas needs to be explored to determine how much time is saved and whether or not every student can benefit. Otherwise, the true impact on the database curriculum will not be known.

Chapter 6 – Conclusion

Industry and professional organizations recommend that colleges increase the number of topics offered in their database courses. Although this request is valid, credit hours are not necessarily being added to college programs making the inclusion of more topics difficult. This conundrum is forcing educators to look at alternatives. Numerous educators are investigating separate database certificates or new programs to provide solutions. Two educators, Murray and Guimaraes (2008) are using instructional tools to deliver course content more effectively and efficiently.

This research project also explored the use of instructional tools to deepen student understanding and accelerate learning, asserting students could acquire more knowledge with the time gained. A 3-D instructional tool, Second Life, was used to build a prototype of a virtual world. In the prototype, a 3-D representation was created to teach students about database concepts such as entities and relationships. After viewing the prototype, students used the 3-D images to create an inventory database in Microsoft Access using fields, records, data types, tables, keys and relationships Students also learned about database concepts using traditional teaching methods. Once the students utilized both methods, feedback was gathered through student comments and an online survey.

Eighty two percent of the students surveyed agreed that the model clarified concepts such as records, tables, primary keys and relationships. Seventy five percent of the respondents believed Second Life reduced the amount of time required to learn about these concepts. Fourteen percent neither disagreed nor agreed. Eleven percent disagreed with that assertion. None of the students strongly disagreed.

The results of the survey indicate that for the majority of students, Second Life decreased the amount of time required to learn about database concepts. Therefore, instructional tools such as Second Life can be used by faculty to reduce the amount of time needed to teach database concepts. However, the question becomes how much time is actually saved?

To quantify how much time is saved using a virtual world, a second project needs to be completed using two different classes for comparison purposes. Ideally, one class would use the traditional method to learn about database concepts and the second class would use a 3-D model exclusively. This way, the classes could be compared to determine how much time is gained by using the model. Also, more questions need to be asked to discover the source of confusion for some students using the model. Perhaps, the model is not appropriate for all learning styles or maybe the model needs additional changes to enhance student understanding. Each of these areas needs to be explored to determine how much time is saved and whether or not every student can benefit. Otherwise, the true impact on the database curriculum will not be known.

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Appendix A – Part 1

Arriving at Welcome Island in Second Life – Learning the Basics

1) Creating an avatar. My original outfit for my avatar, Database Engineer, was the Female Student Outfit.

2) Learning to walk – use the arrow keys to the right of your keyboard

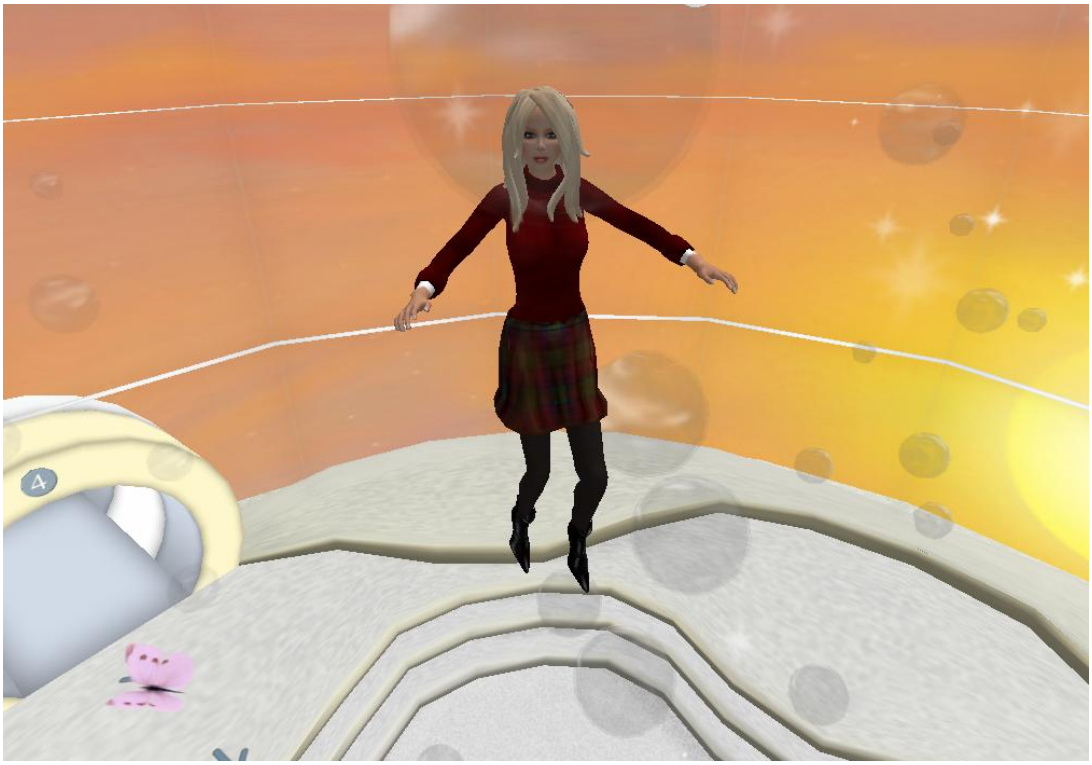
3) Zooming with the keyboard explained – use mouse scroll button

4) Discovering how to chat in SL (talking using IM features) – utilize chat box on bottom left of the SL screen

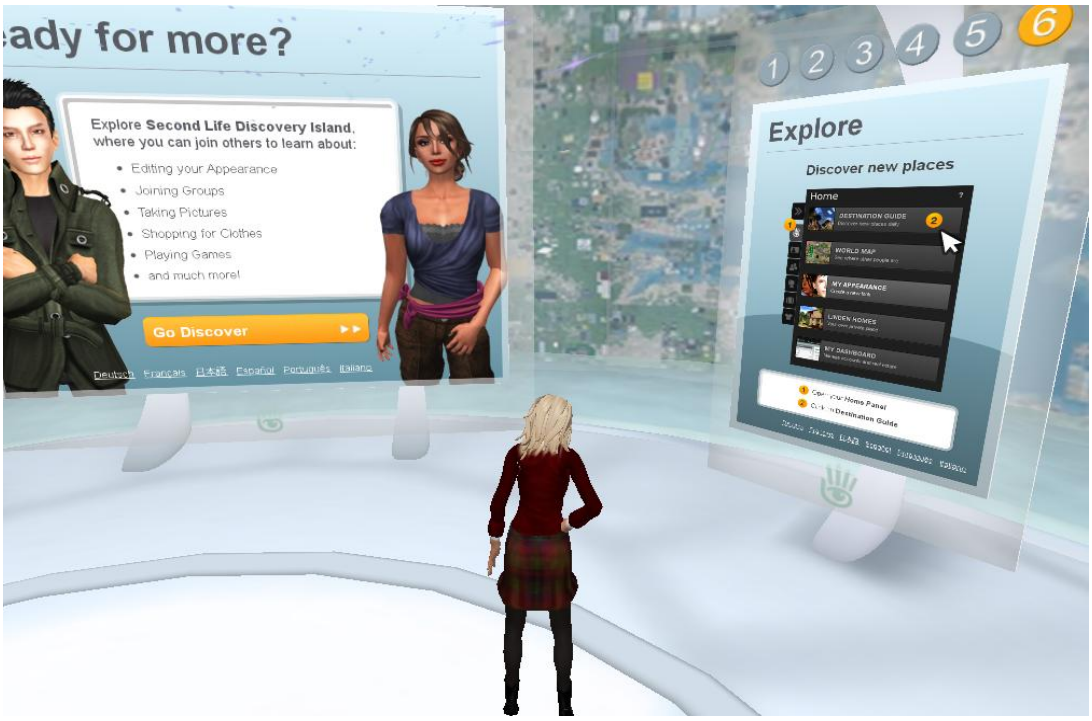
5) Learning about sitting – right click on chair or sofa and select sit option

6) Reading about flying – use up page up or the button with arrows under SL move option

7) Learning to fly – try moving around with arrow keys, page up and page down buttons



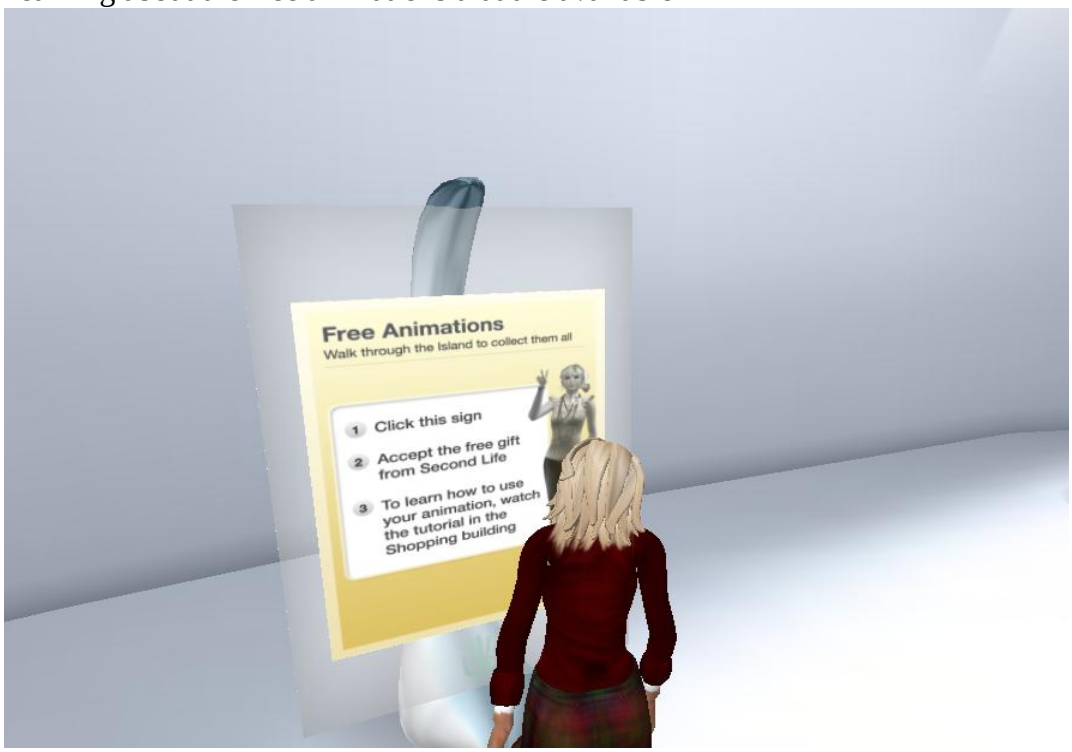
8) Taking the next step – Teleport to Discovery Island



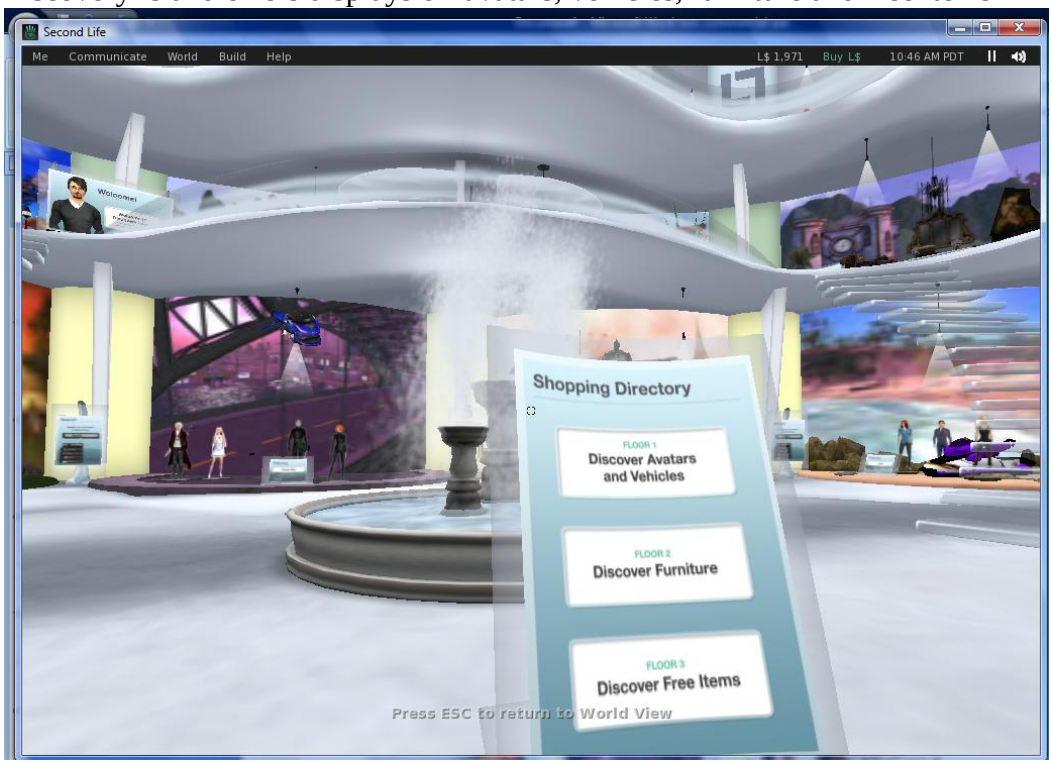
Appendix A – Part 2

Teleporting to Discovery Island and Obtaining Free items

1) Learning about the free animations that are available

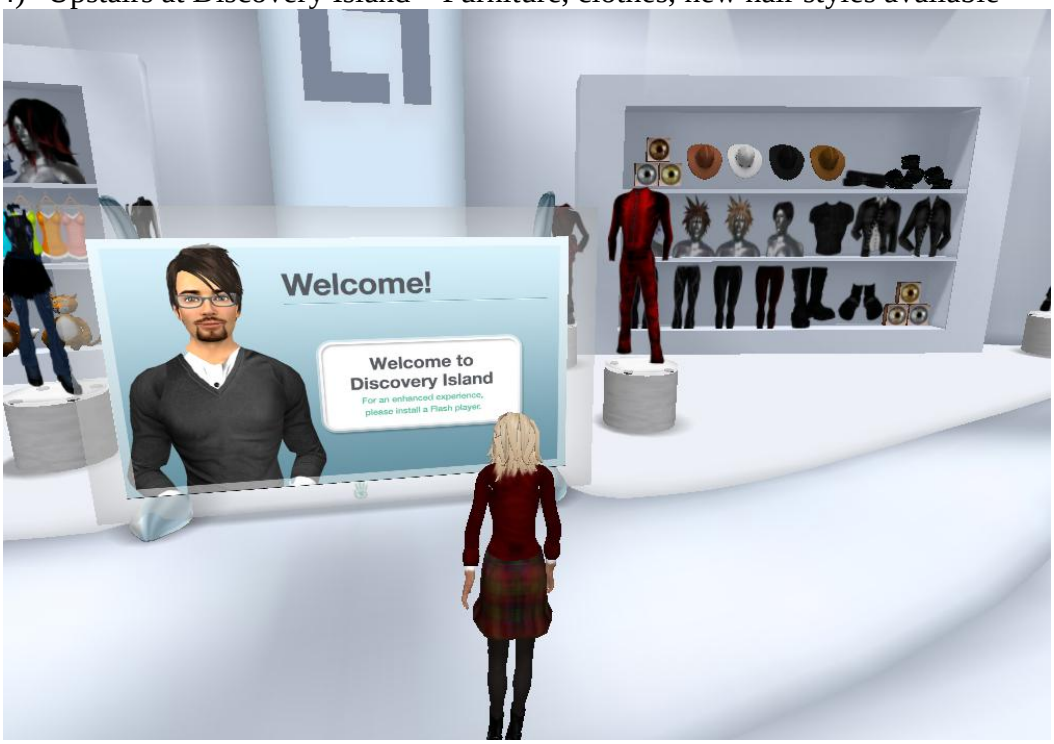


2) Discovery Island offers displays of avatars, vehicles, furniture and free items



3) A view of different avatars at Discovery Island

4) Upstairs at Discovery Island – Furniture, clothes, new hair styles available



5) Purchase items for free by touching or right clicking on the items. Select buy (for zero dollars) or select the option to take a copy (if offered).

Appendix A – Part 3

Visiting Orientation and Help Island

1) Learning to change your appearance (wait to actually change avatar until you have free cloths from Help Island)

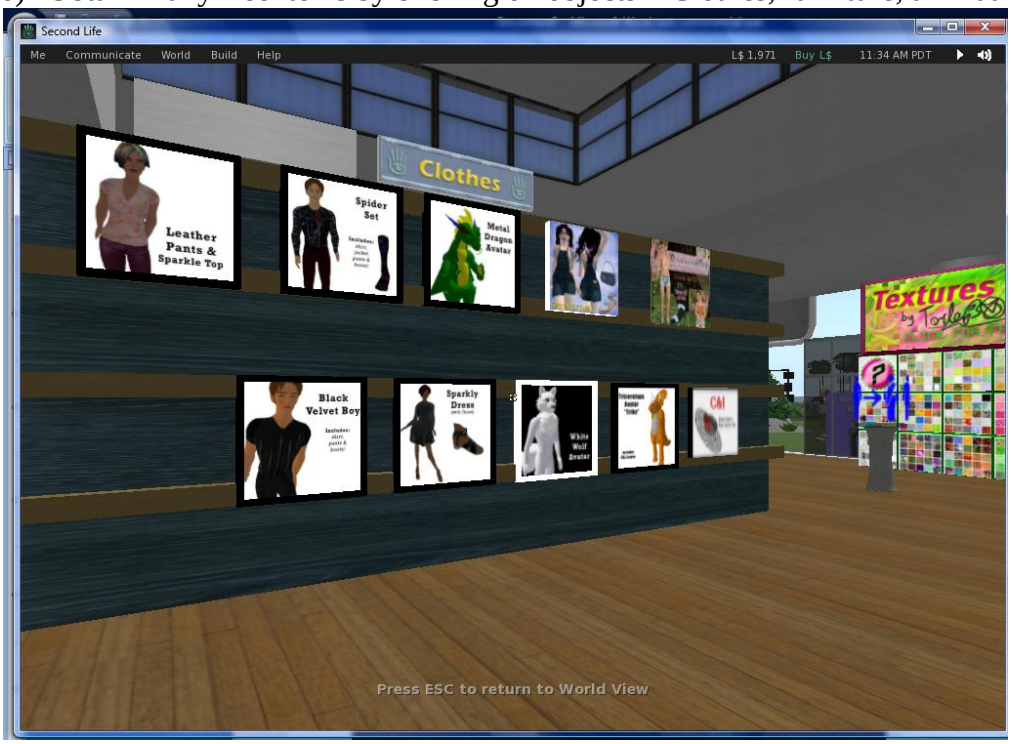
2) Using your mouse to get a better visual (moving closer to objects)

3) Learning how to move items – move the ball to the table with hand

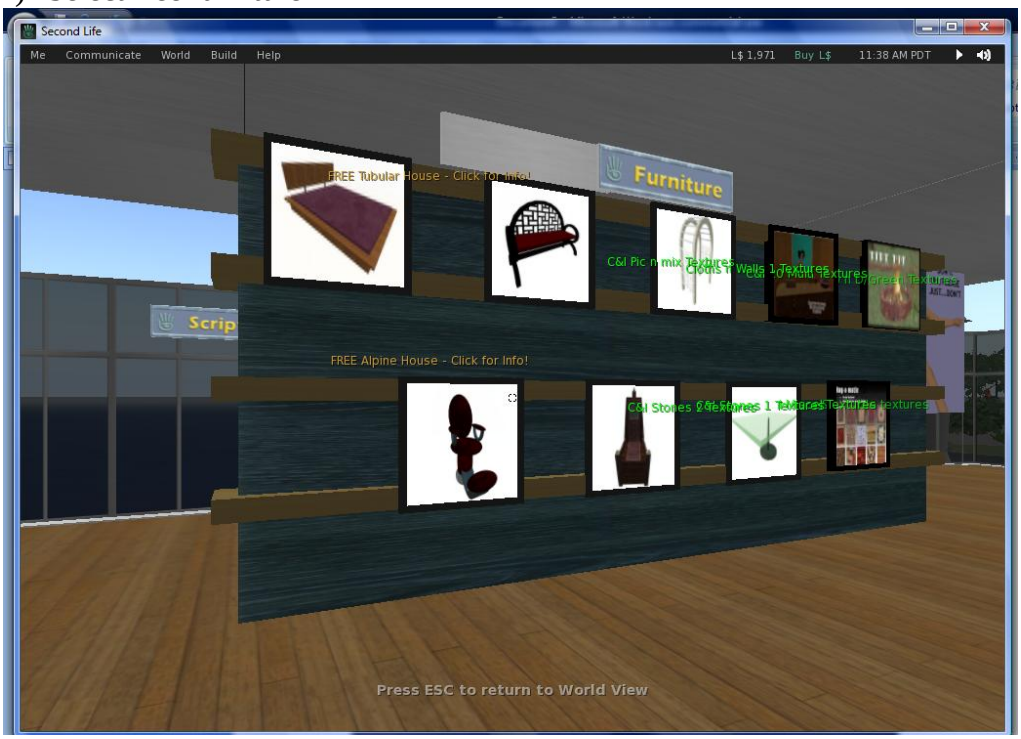
4) Fly to last station at Orientation Island

5) Search for Help using SL search option. Next, choose to teleport to Help Island

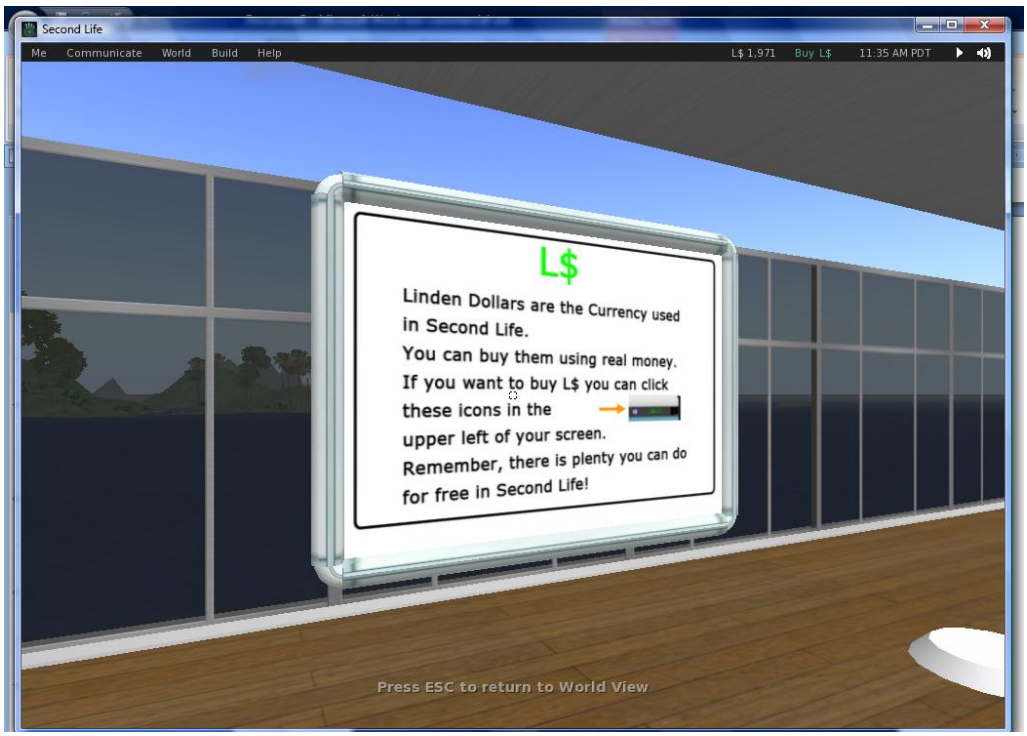
6) Obtain many free items by clicking on objects – Clothes, furniture, animations and more



7) Select free furniture

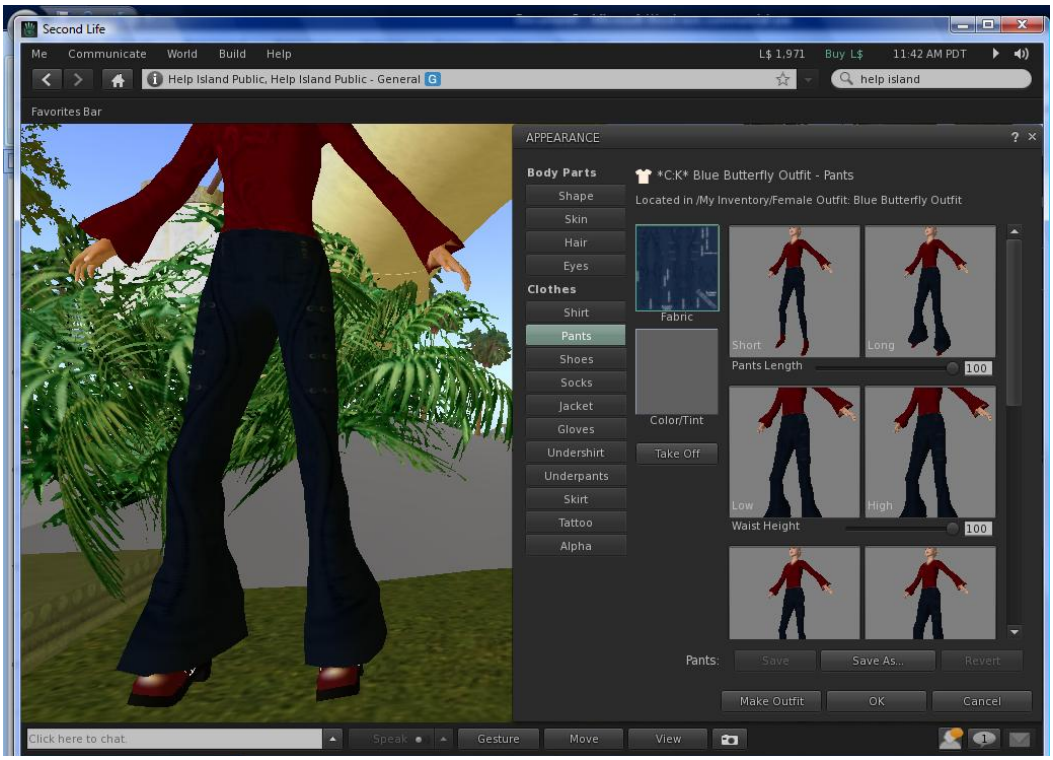


8) Find out about the SL currency – Linden dollars ($2000 Linden = $7.99 US dollars)

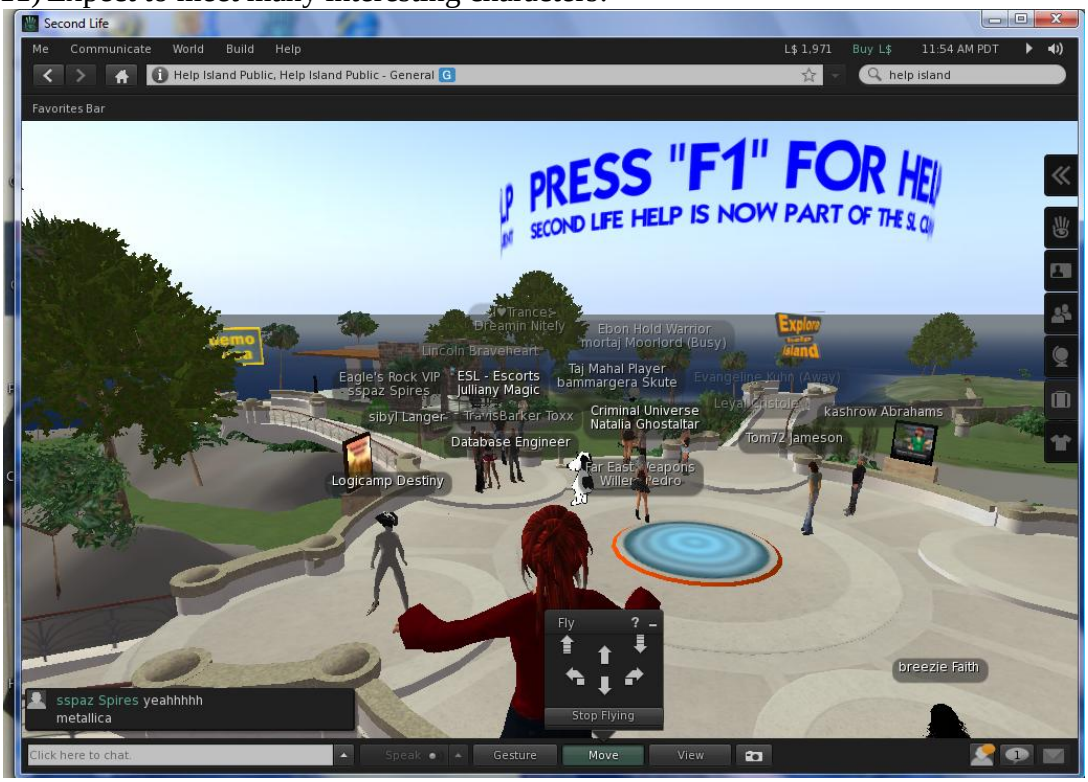


9) Create custom appearance using new items stored in inventory – drag onto avatar

10) Right click on avatar and make changes to your appearance as required

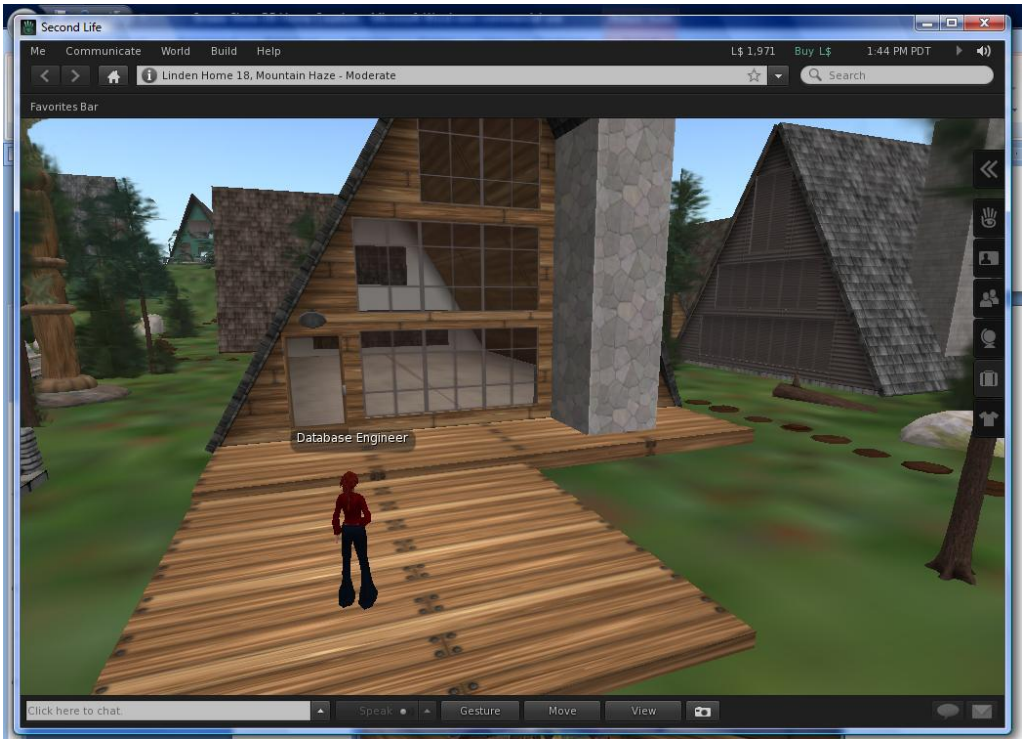


11) Expect to meet many interesting characters!

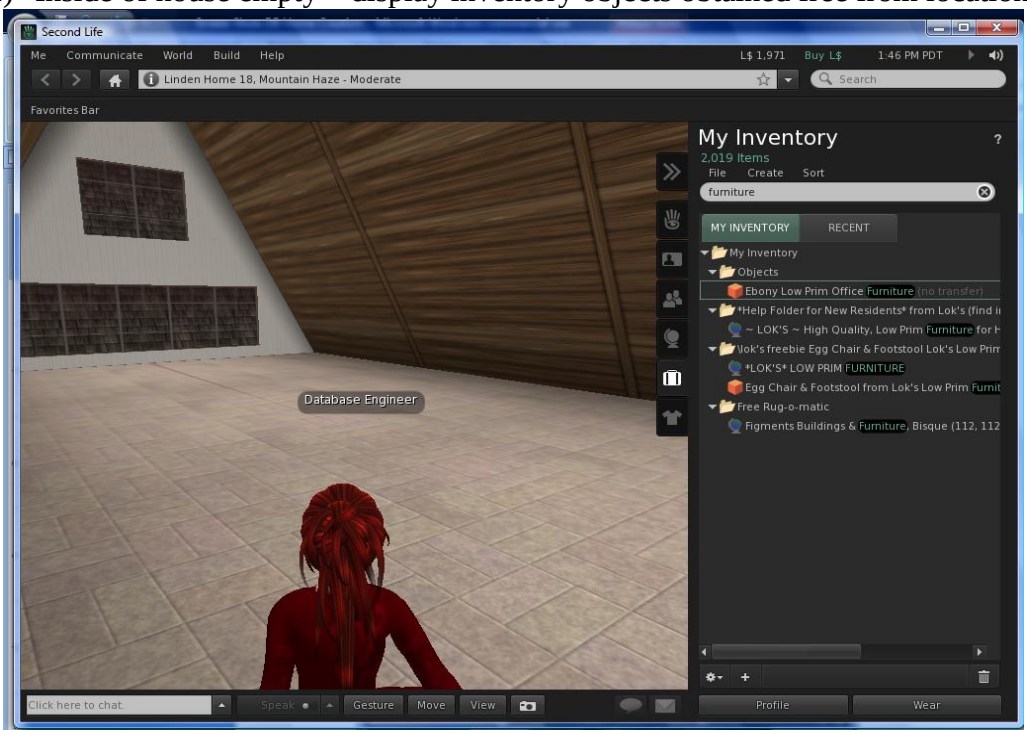


Appendix B – Filling the Second Life house with furniture

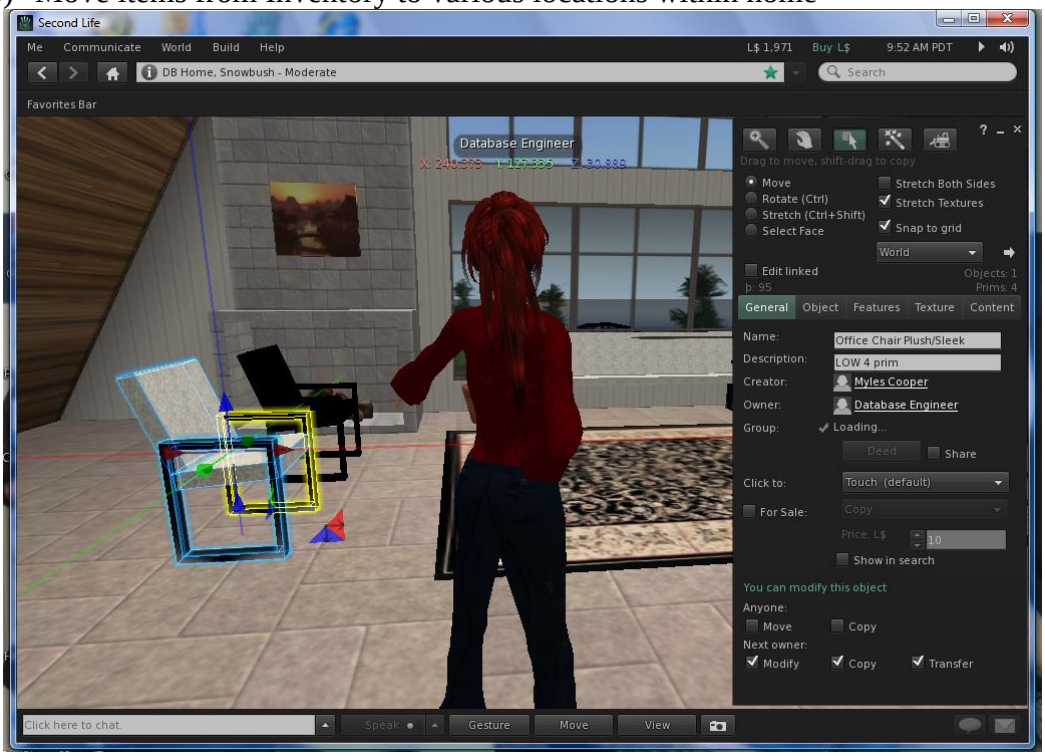
1) Original House – Provided with Premium Addition of SL (22.50 per quarter) - Unfurnished



2) Inside of house empty – display inventory objects obtained free from locations within SL

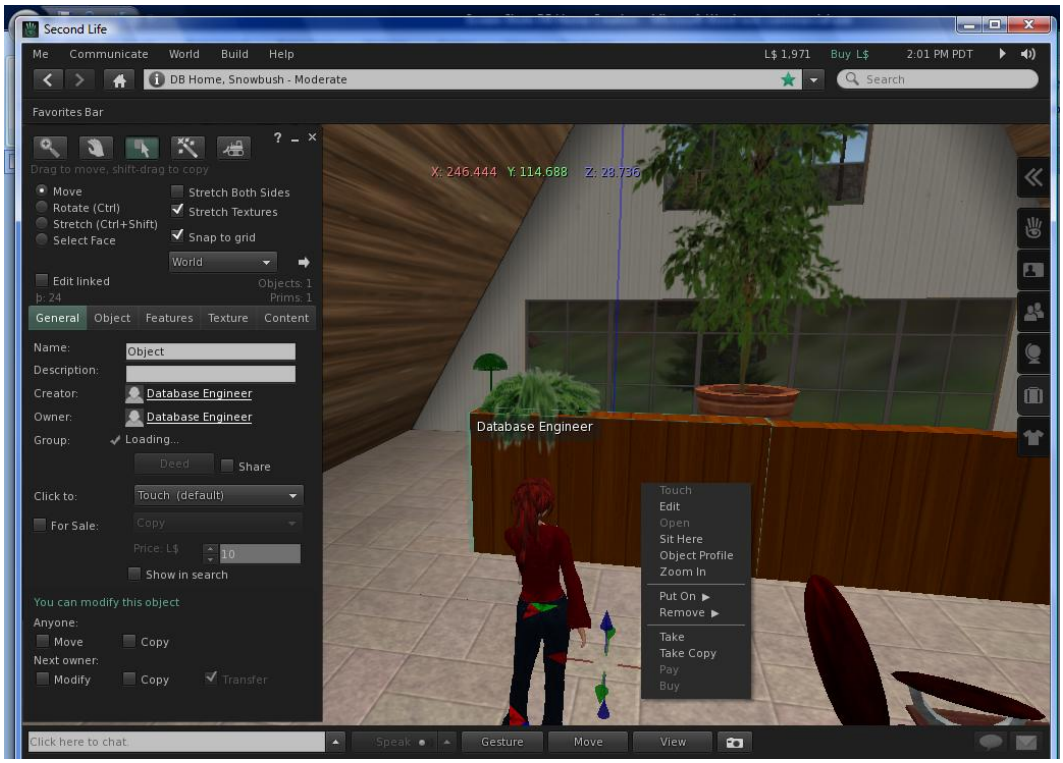


3) Move items from Inventory to various locations within home



4) Change Object Colors to create variety of furniture looks

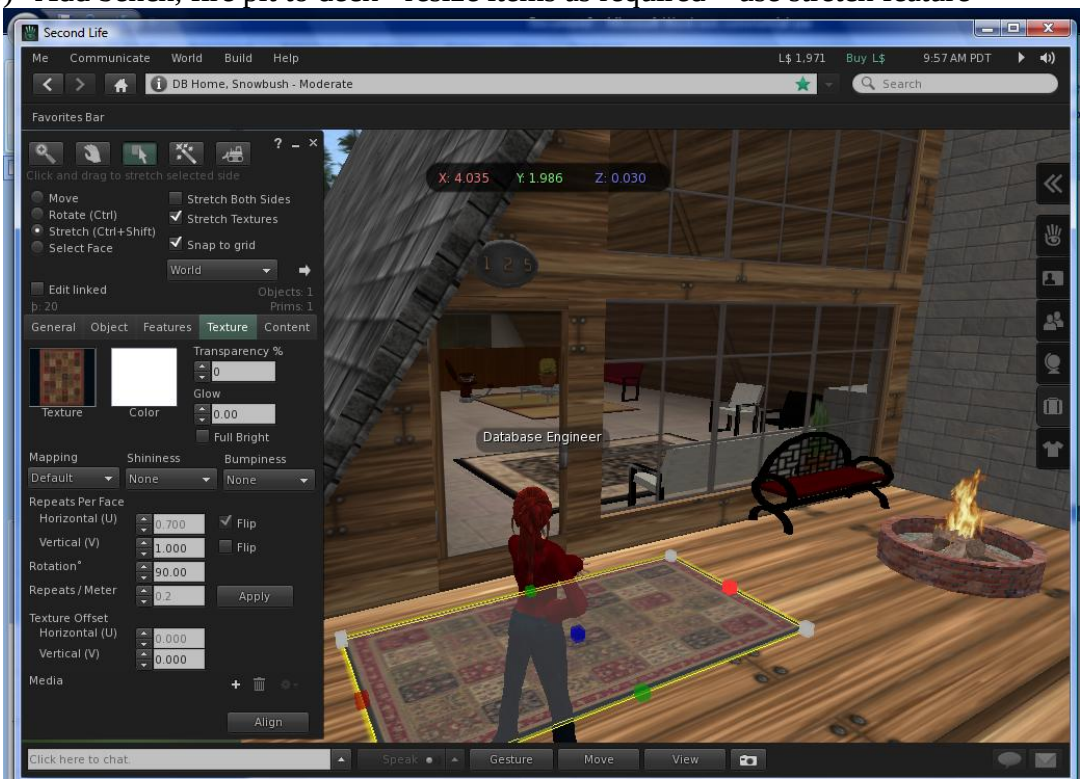
5) Create bedroom wall with build tool, add more plants and a lamp



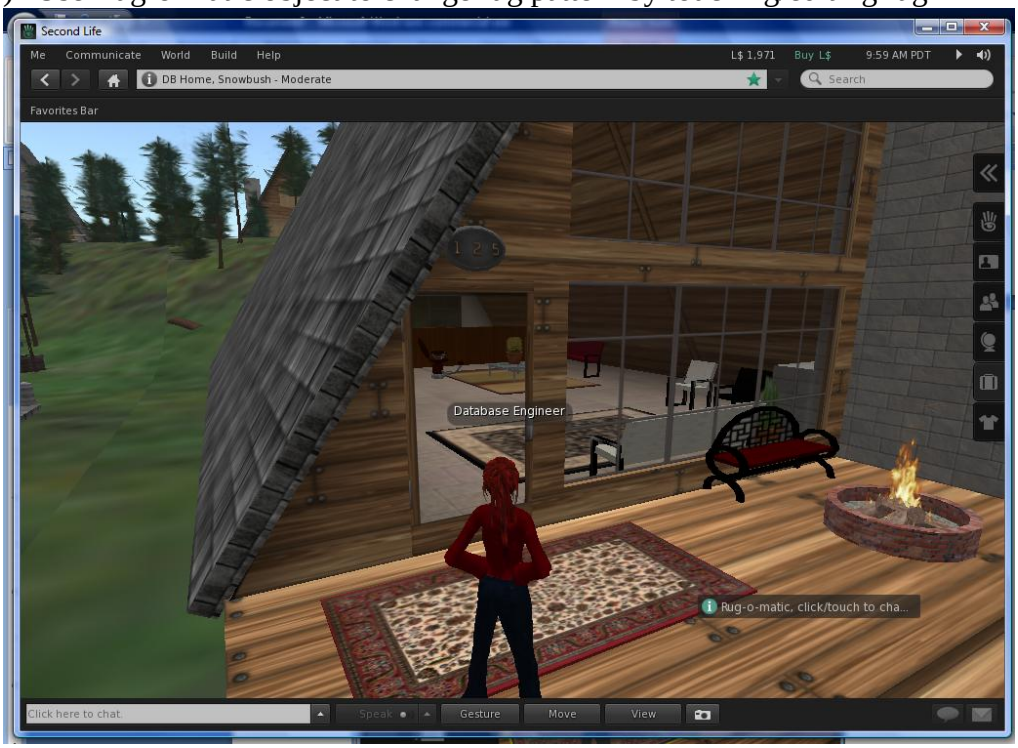
6) Completed bedroom

7) View of the rest of the inside of the house with all the furniture added

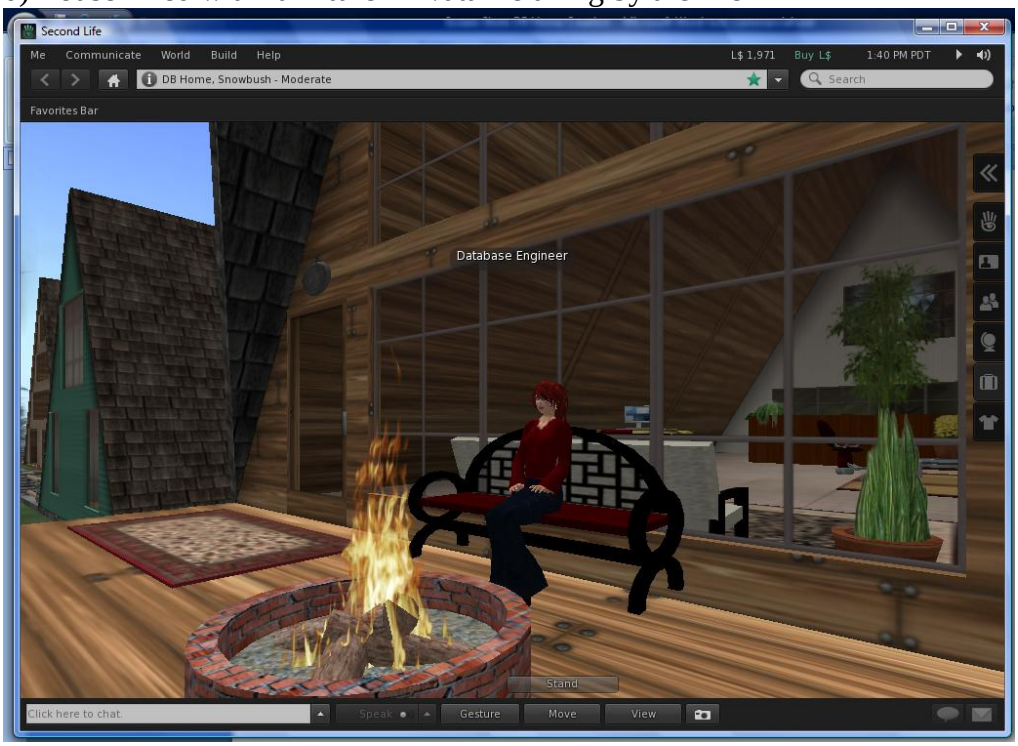
8) Add bench, fire pit to deck - resize items as required – use stretch feature



9) Use Rug-o-matic object to change rug pattern by touching/editing rug



10) House filled with furniture - Avatar relaxing by the fire



Appendix C

Instructions for Database (DB) Home and the Inventory Database

To enter the house, touch the door. After entering the house, locate the items to create an inventory database. The inventory database must contain information regarding the desk, chairs, sofas, and bed. Do NOT include information about plants, rugs, coffee tables or other miscellaneous items.

To find information for the database fields, touch the items (such as the chairs) and when prompted, keep the "note card". After clicking the keep button, the note card should appear on your screen. The note card contains the data needed for the different fields in the database.

In the database, you must relate the furniture to a specific room. Inside DB Home, there are 4 rooms (living room, den, office and bedroom). Remember to associate (relate) each piece of furniture with a specific room.

To speed up the data entry process, an excel spreadsheet is provided. In the spreadsheet, chairs, desks, beds and sofas have a serial number. For example, a chair serial number is CH-1234 and a sofa serial number is SF-5000. The spreadsheet contains much of the information needed to create the database. However, you must locate and fill in any missing information (highlighted in yellow on the spreadsheet). To open the spreadsheet, please select the link below:

DB Home Inventory Spreadsheet

After completing the spreadsheet and collecting the information for the database, answer the following questions:

- **What table name(s) will you use for your database?**
- **What are the field headers and the primary key(s)?**
- **What are the data types for each field?**

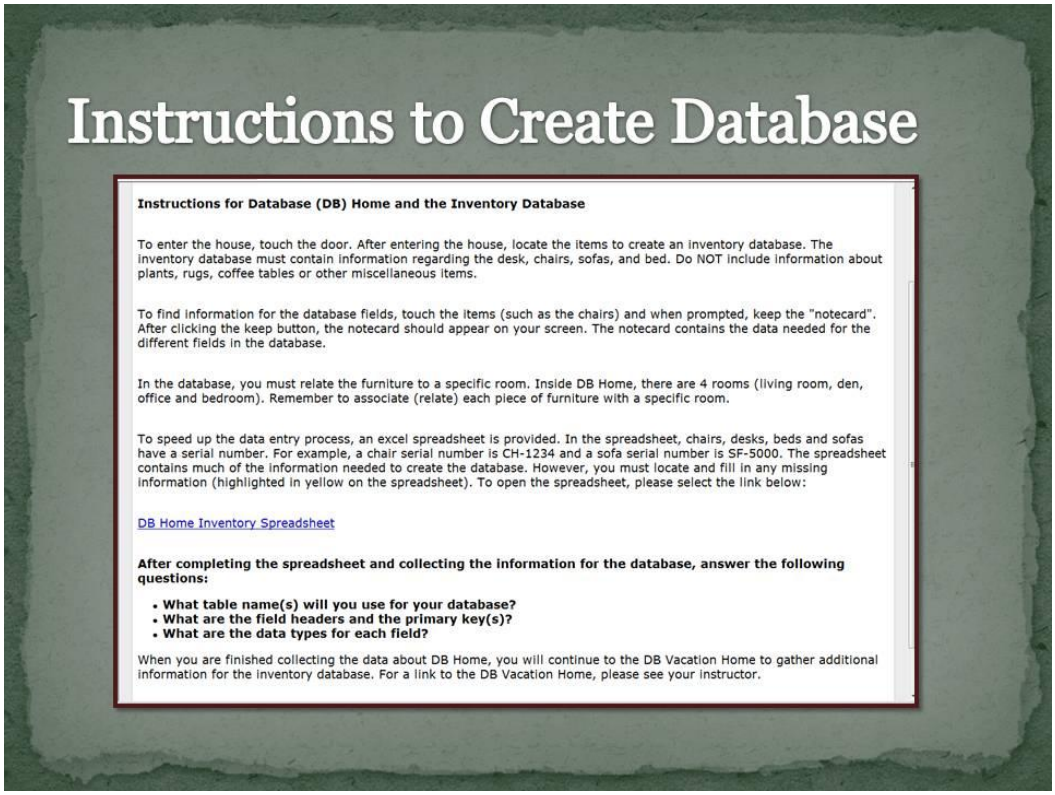
When you are finished collecting the data about DB Home, you will continue to the DB Vacation Home to gather additional information for the inventory database. For a link to the DB Vacation Home, please see your instructor.

Appendix D

Overview

- Utilize Second Life image of a virtual home, DB Home, to create Access database
- Avatar named Database Engineer collects data for database
- Inventory database contains two tables
  - Furniture
  - Rooms
- Students relate Furniture table to Room table

Database Home in Second Life
Click box for instructions
Second Life
Me Communicate World Build Help
DB Home, Snowbush - Moderate
buy additional house
Favorites Bar
Database Engineer
Welcome to Database (DB) Home
TOUCH FOR LINK TO INSTRUCTIONS
Click here to chat
Speak
Gesture
Move
View


Instructions to Create Database
Instructions for Database (DB) Home and the Inventory Database
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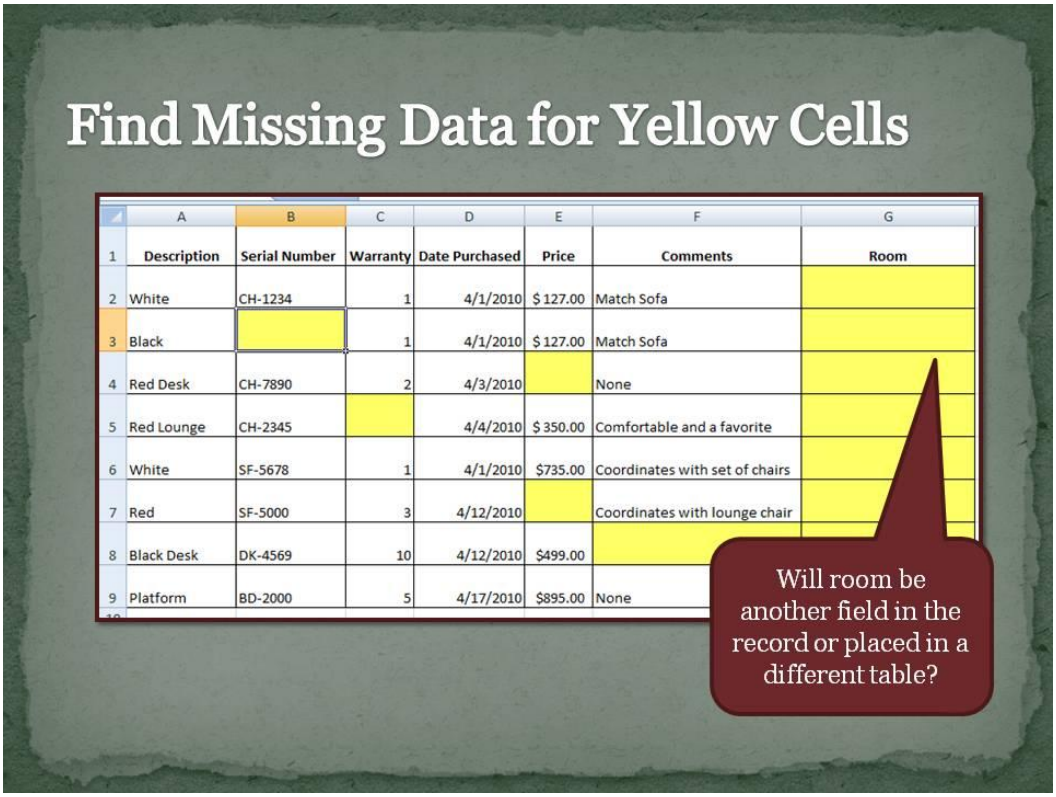
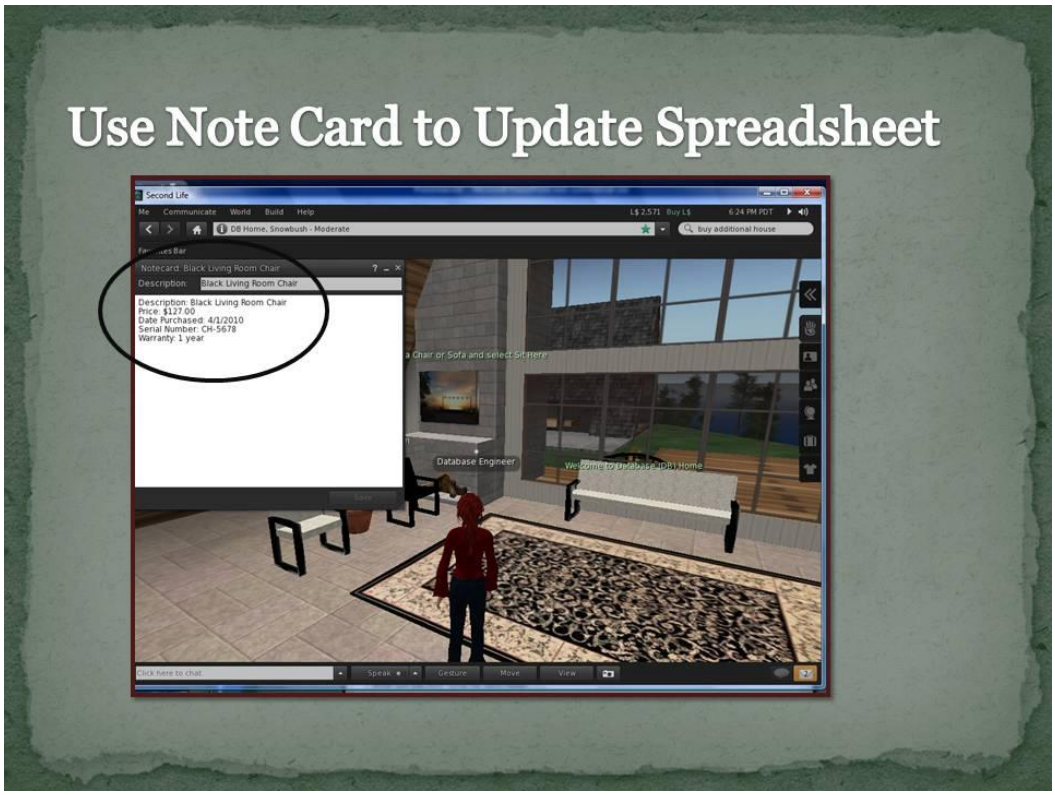
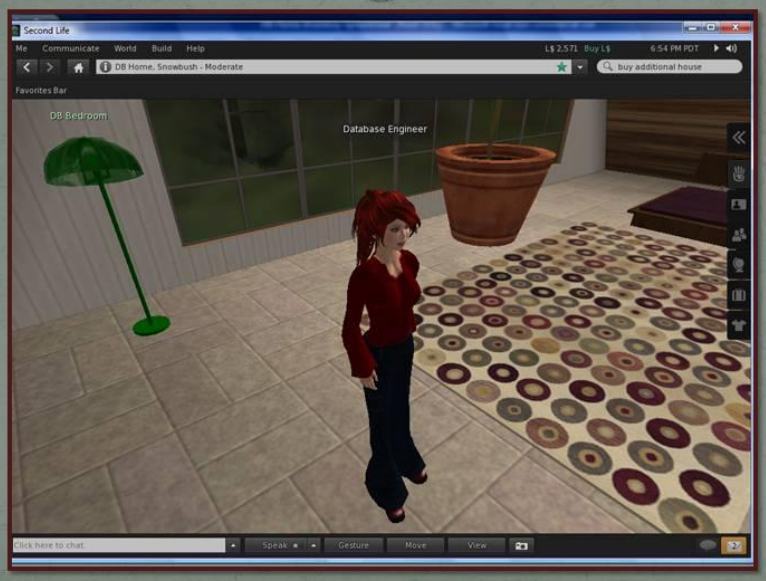


	A	B	C	D	E	F	G
1	Description	Serial Number	Warranty	Date Purchased	Price	Comments	Room
2	White	CH-1234	1	4/1/2010	$ 127.00	Match Sofa	
3	Black		1	4/1/2010	$ 127.00	Match Sofa	
4	Red Desk	CH-7890	2	4/3/2010		None	
5	Red Lounge	CH-2345		4/4/2010	$ 350.00	Comfortable and a favorite	
6	White	SF-5678	1	4/1/2010	$735.00	Coordinates with set of chairs	
7	Red	SF-5000	3	4/12/2010		Coordinates with lounge chair	
8	Black Desk	DK-4569	10	4/12/2010	$499.00		
9	Platform	BD-2000	5	4/17/2010	$895.00	None	

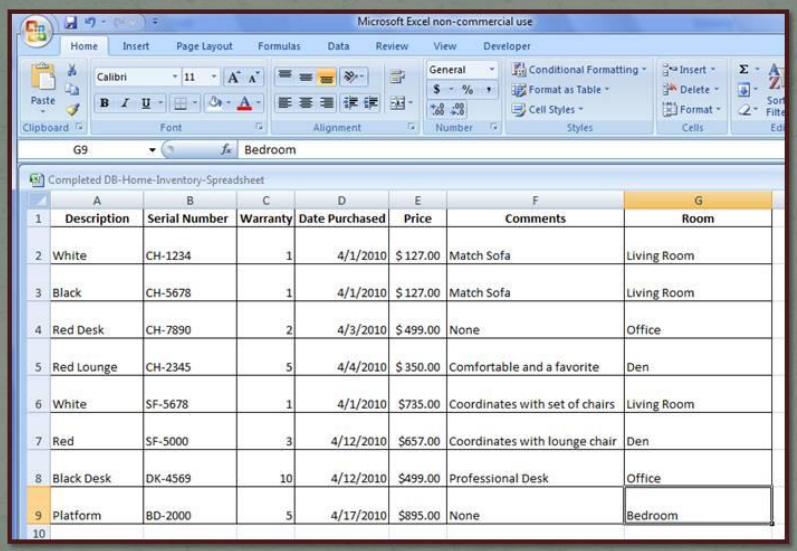

Use Note Card to Update Spreadsheet
Second Life
Me Communicate World Build Help
DB Home, Snowbush - Moderate
buy additional house
Notecard: Black Living Room Chair
Description: Black Living Room Chair
Description: Black Living Room Chair
Price: $127.00
Date Purchased: 4/1/2010
Serial Number: CH-5678
Warranty: 1 year
Database Engineer
Click here to chat
Speak
Gesture
Move
View

Gather Data From Each Room
Second Life
Me Communicate World Build Help
DB Home, Snowbush - Moderate
buy additional house
Favorites Bar
The Office
Database Engineer
Welcome to the Den
Click here to chat
Speak
Gesture
Move
View

Finish Collecting Data

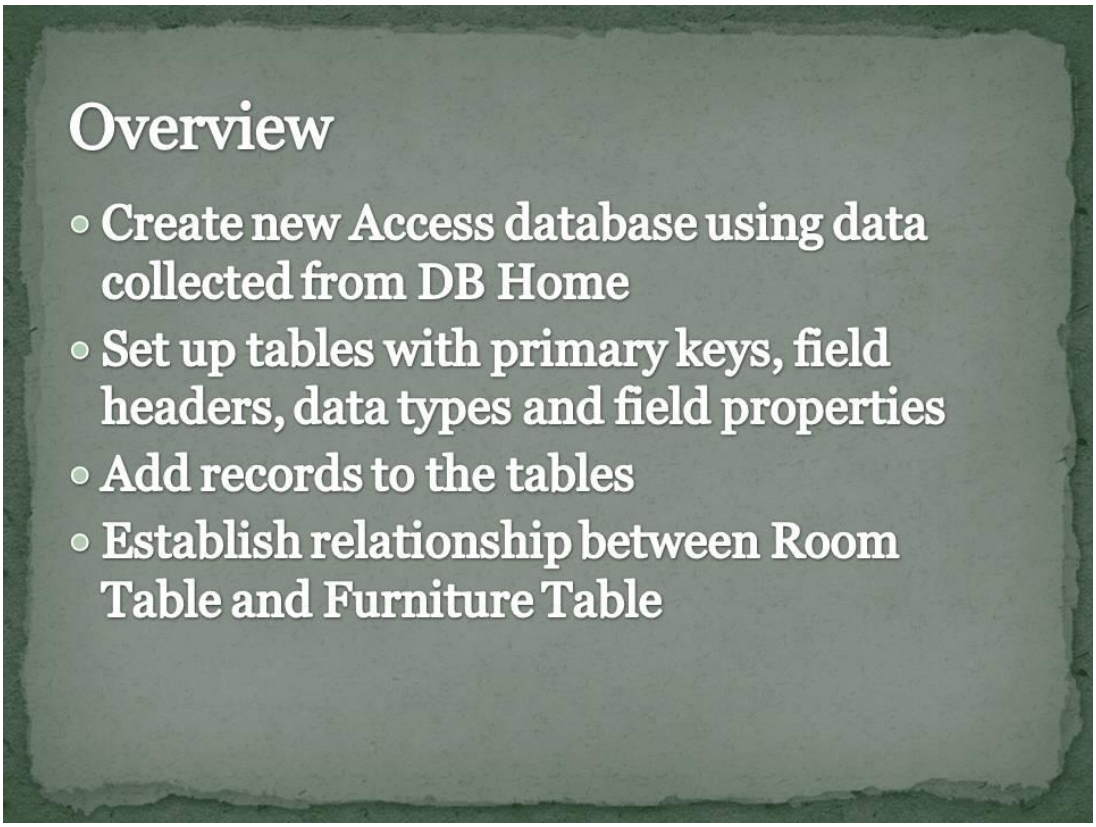


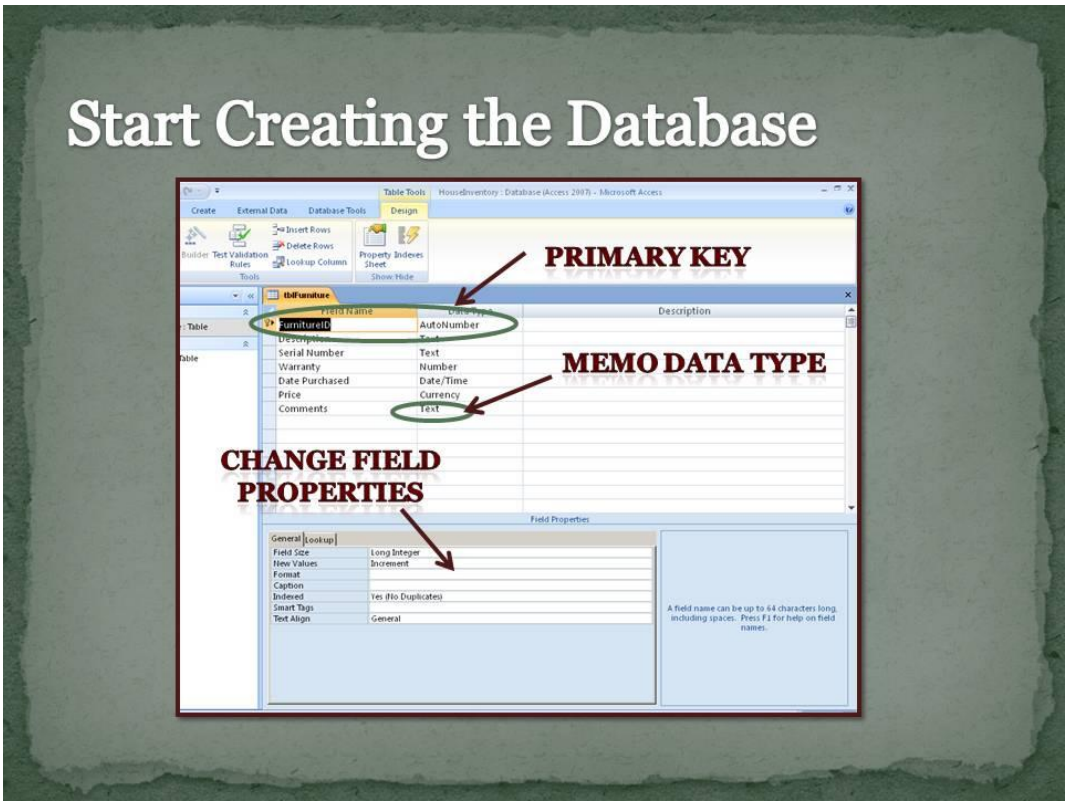
Completed Spreadsheet

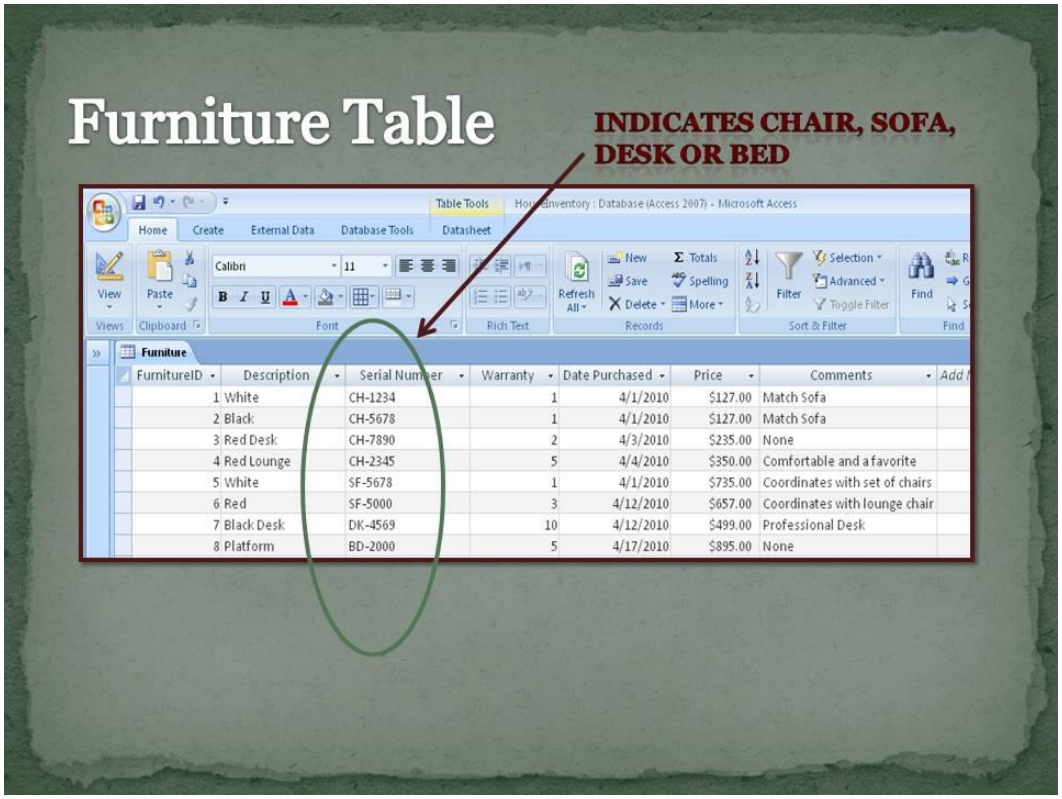


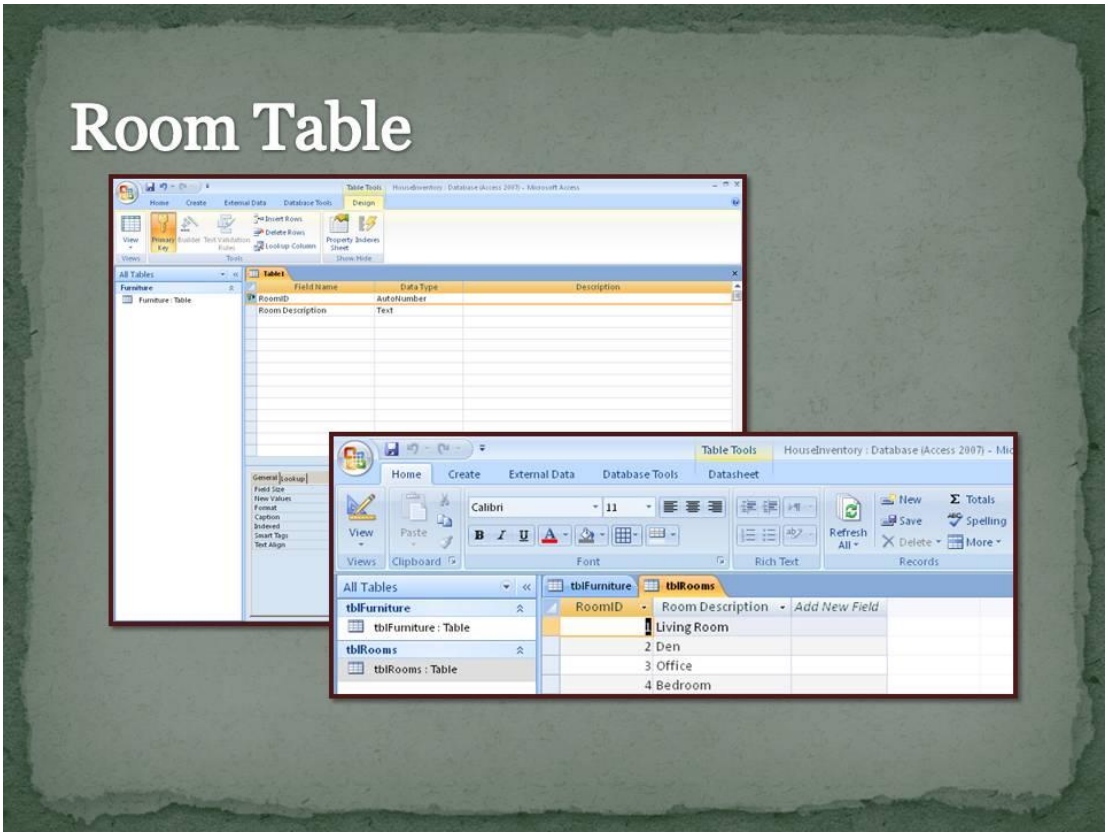
	A	B	C	D	E	F	G
1	Description	Serial Number	Warranty	Date Purchased	Price	Comments	Room
2	White	CH-1234	1	4/1/2010	$ 127.00	Match Sofa	Living Room
3	Black	CH-5678	1	4/1/2010	$ 127.00	Match Sofa	Living Room
4	Red Desk	CH-7890	2	4/3/2010	$ 499.00	None	Office
5	Red Lounge	CH-2345	5	4/4/2010	$ 350.00	Comfortable and a favorite	Den
6	White	SF-5678	1	4/1/2010	$735.00	Coordinates with set of chairs	Living Room
7	Red	SF-5000	3	4/12/2010	$657.00	Coordinates with lounge chair	Den
8	Black Desk	DK-4569	10	4/12/2010	$499.00	Professional Desk	Office
9	Platform	BD-2000	5	4/17/2010	$895.00	None	Bedroom
10							

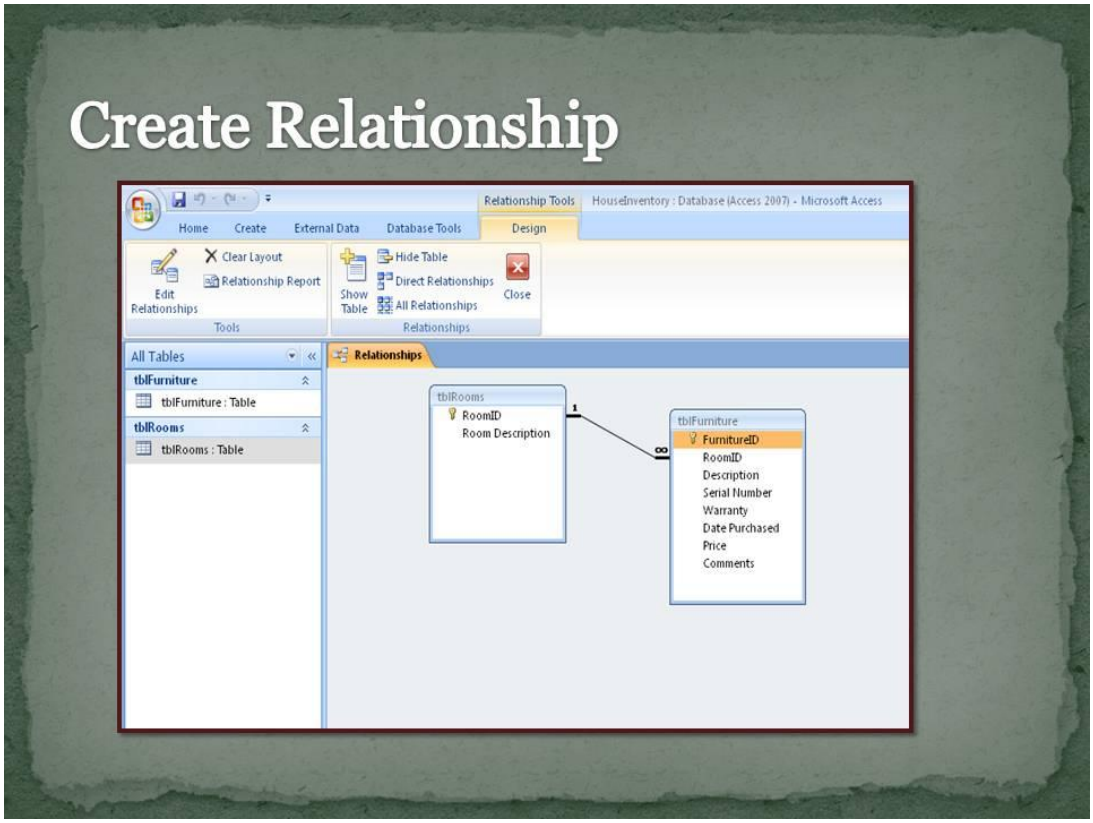
Database Engineer
Database Concepts
in a Virtual World
Part One B
Janet L. Ochs

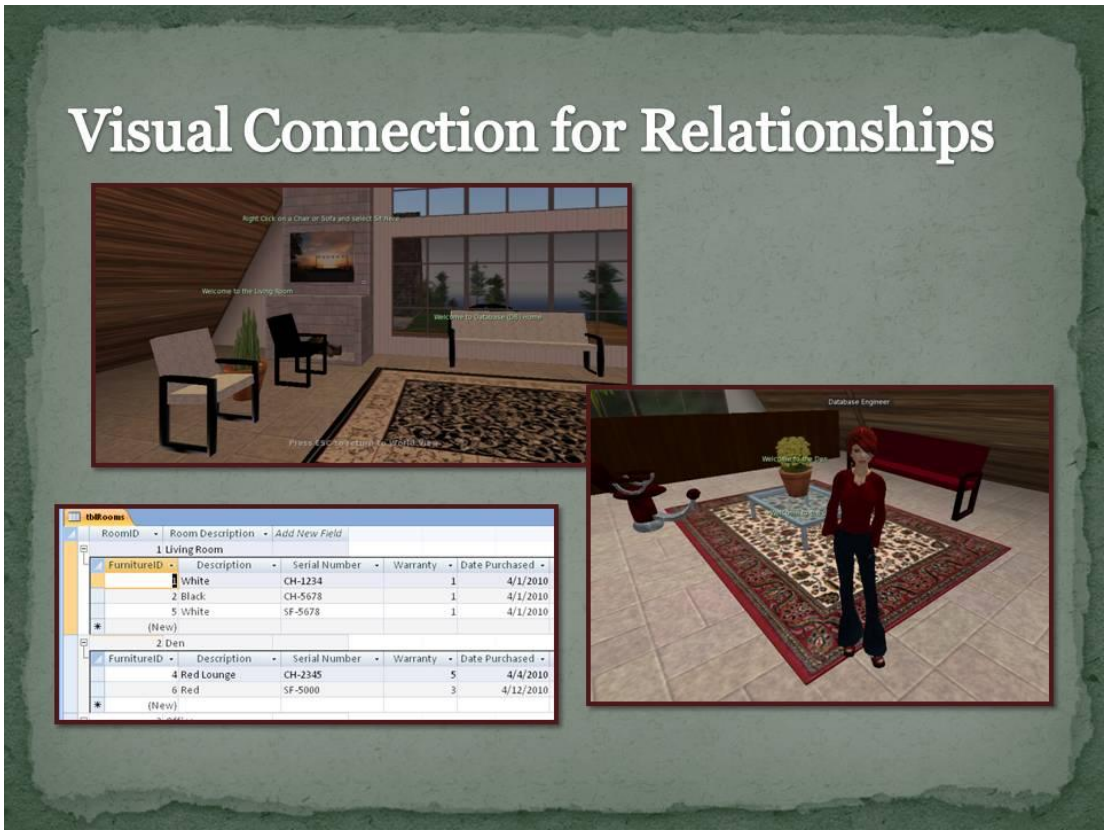

Overview
Create new Access database using data collected from DB Home
Set up tables with primary keys, field headers, data types and field properties
Add records to the tables
Establish relationship between Room Table and Furniture Table

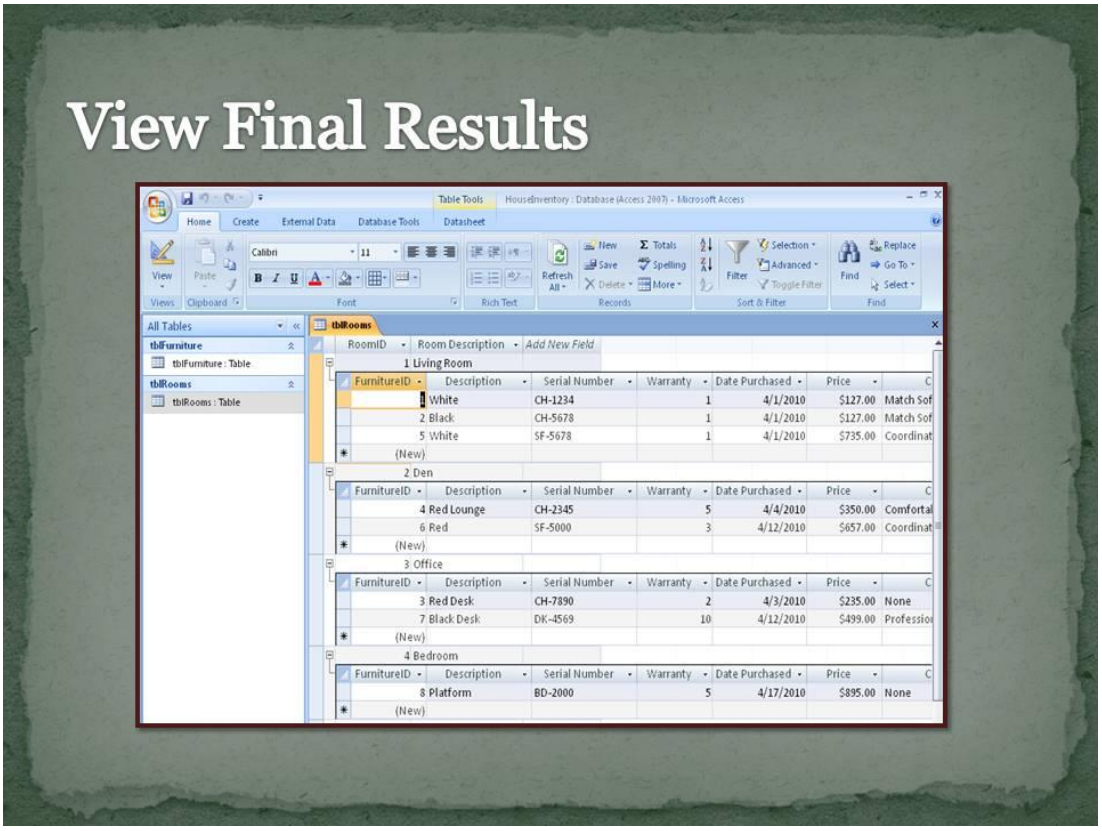

Start Creating the Database
PRIMARY KEY
MEMO DATA TYPE
CHANGE FIELD PROPERTIES


Furniture Table
INDICATES CHAIR, SOFA, DESK OR BED


Room Table
Table Tools
HouseInventory : Database (Access 2007) - Mic
Home
Create
External Data
Database Tools
Datasheet
View
Paste
Views
Clipboard
Calibri
11
Font
Rich Text
Refresh All
New
Save
Delete
Totals
Spelling
More
Records
All Tables
tblFurniture
tblFurniture : Table
tblRooms
tblRooms : Table
RoomID
Room Description
Add New Field
1 Living Room
2 Den
3 Office
4 Bedroom


Create Relationship
Relationship Tools
HouseInventory : Database (Access 2007) - Microsoft Access
Home
Create
External Data
Database Tools
Design
Edit Relationships
Clear Layout
Relationship Report
Tools
Show Table
Hide Table
Direct Relationships
All Relationships
Close
Relationships
All Tables
tblFurniture
tblFurniture : Table
tblRooms
tblRooms : Table
Relationships
tblRooms
RoomID
Room Description
1
∞
tblFurniture
FurnitureID
RoomID
Description
Serial Number
Warranty
Date Purchased
Price
Comments


Visual Connection for Relationships
tblRooms
RoomID
Room Description
Add New Field
1 Living Room
FurnitureID
Description
Serial Number
Warranty
Date Purchased
1 White CH-1234 1 4/1/2010
2 Black CH-5678 1 4/1/2010
5 White SF-5678 1 4/1/2010
(New)
2 Den
4 Red Lounge CH-2345 5 4/4/2010
6 Red SF-5000 3 4/12/2010
(New)
Database Engineer


View Final Results
Table Tools
HouseInventory : Database (Access 2007) - Microsoft Access
Home
Create
External Data
Database Tools
Datasheet
All Tables
tblFurniture
tblFurniture : Table
tblRooms
tblRooms : Table
RoomID
Room Description
Add New Field
1 Living Room
FurnitureID
Description
Serial Number
Warranty
Date Purchased
Price
1 White CH-1234 1 4/1/2010 $127.00 Match Sof
2 Black CH-5678 1 4/1/2010 $127.00 Match Sof
5 White SF-5678 1 4/1/2010 $735.00 Coordinat
(New)
2 Den
4 Red Lounge CH-2345 5 4/4/2010 $350.00 Comfortal
6 Red SF-5000 3 4/12/2010 $657.00 Coordinat
(New)
3 Office
3 Red Desk CH-7890 2 4/3/2010 $235.00 None
7 Black Desk DK-4569 10 4/12/2010 $499.00 Professio
(New)
4 Bedroom
8 Platform BD-2000 5 4/17/2010 $895.00 None
(New)

Next Steps

- Continue to DB Vacation Home using link from instructor
- Add a second House to the inventory database
- Update Furniture Table with more items
- Update Room Table with more rooms
- Create new relationship between Houses and Rooms

Appendix E

Instructions for Database (DB) Vacation Home and the Inventory Database

Welcome to the DB Vacation Home. This is the second house used to create the inventory database. To enter the house, touch the door. After entering the house, find additional items for the inventory database. For the DB Vacation home, include data regarding the chairs, sofa and bed. To find information for the database fields, touch the items (such as the chairs) and when prompted, keep the "notecard". After clicking the keep button, the notecard should appear on your screen. The notecard contains the data needed for the different fields in the database.

In the database, you must relate the furniture to a specific room. Inside DB Vacation Home, there are 2 rooms (the great room and the upstairs bedroom). Remember to relate each piece of furniture to a specific room.

To speed up the data entry process, an excel spreadsheet is provided. The spreadsheet contains the data needed to finish creating the database. However, you must locate and fill in any missing data (highlighted in yellow on the spreadsheet). To open the spreadsheet, please select this link DB Vacation Home Inventory Spreadsheet.

After completing the spreadsheet and collecting the information for the database, answer the following questions:

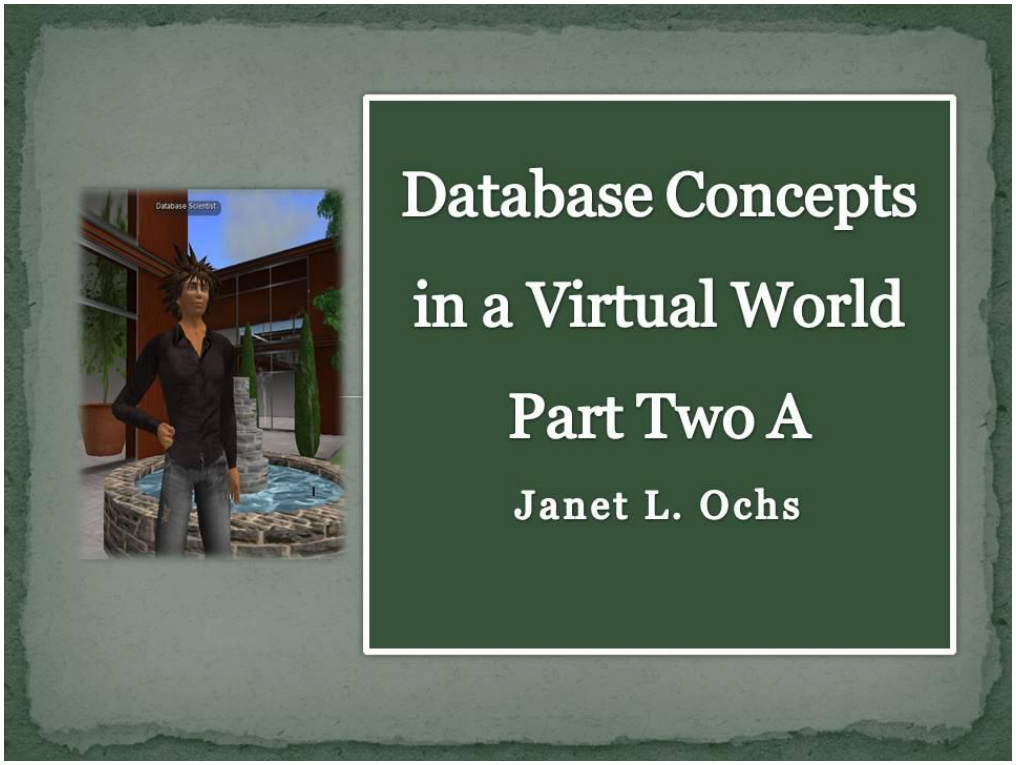
- **How will you relate each piece of furniture to a particular room?**
- **How will you relate each room to a specific house?**
- **How many tables are in your database?**
- **What are the primary and foreign keys?**

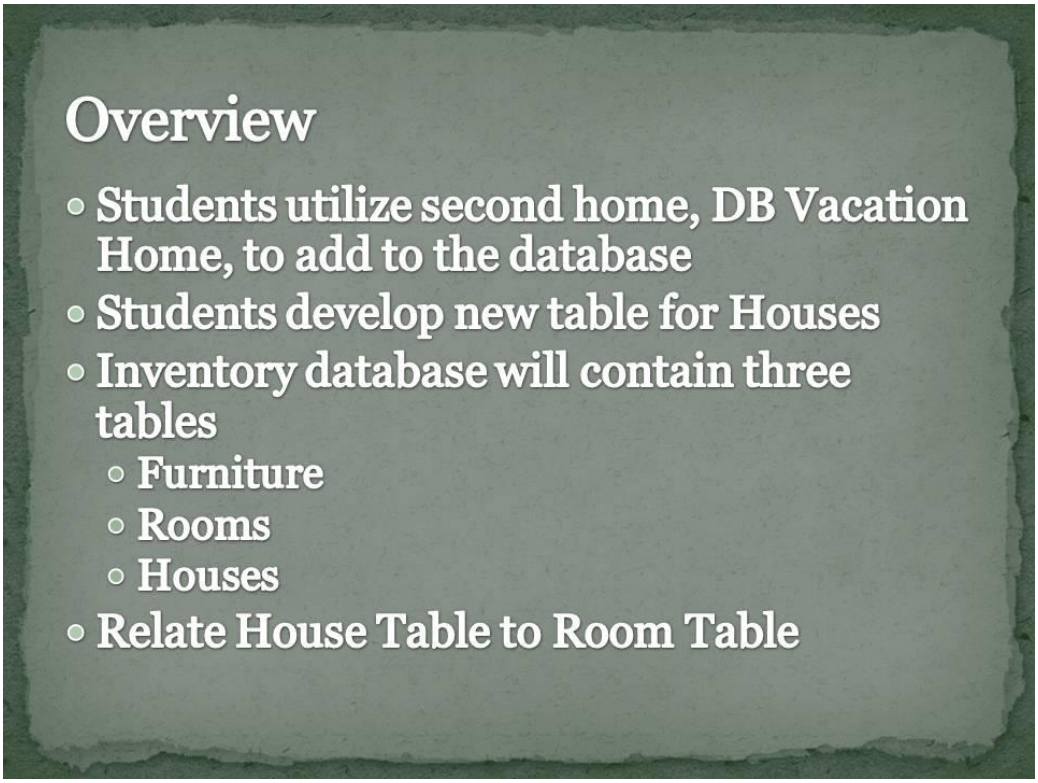
When you are finished collecting the data about DB Vacation Home, you will need to complete the design of your database. When the database is completed, ensure that each piece of furniture in the database is related to a room (living room, great room, den, office, upstairs bedroom or bedroom) and to a specific house (DB Home or DB Vacation Home). **The information needed for the houses is as follows:**

- For DB Home, the House Name is DB Home, the House Type is A-Frame, the House Location is Snowbush and the House Owner is Database Engineer.
- For DB Vacation Home, the House Name is DB Vacation Home, the House Type is Modern, the House Location is Nungu and the House Owner is Database Scientist.

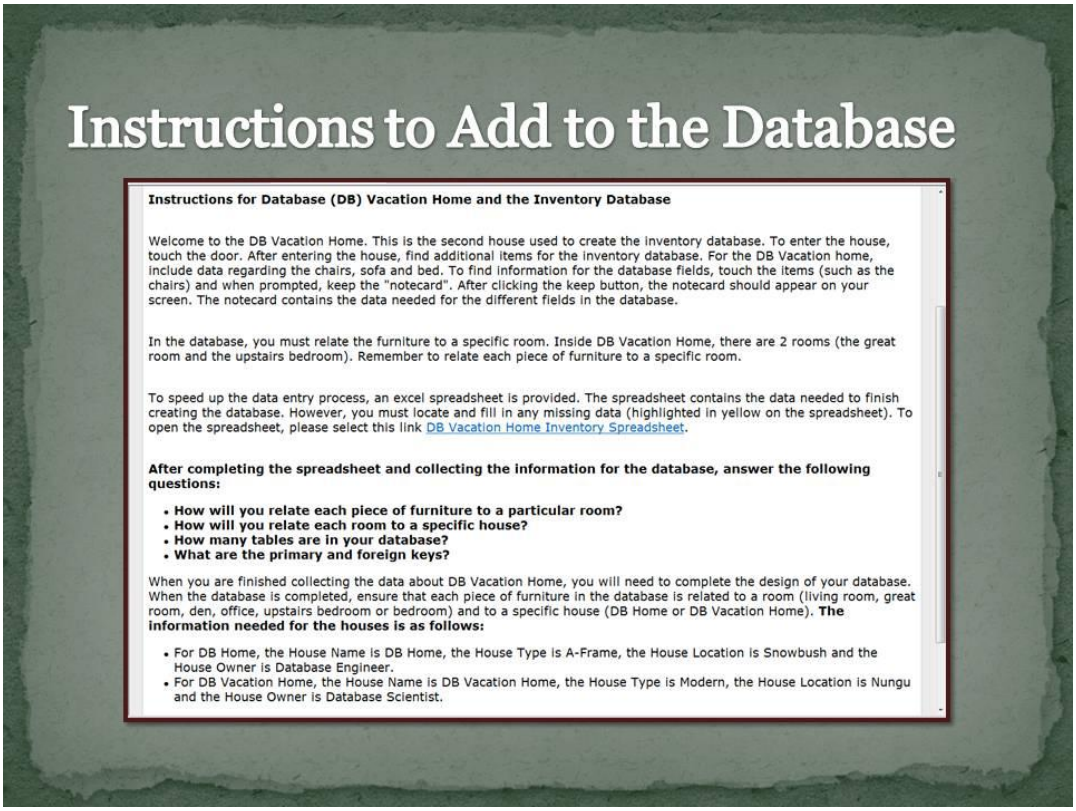
For a link to an inventory database solution, please see your instructor.

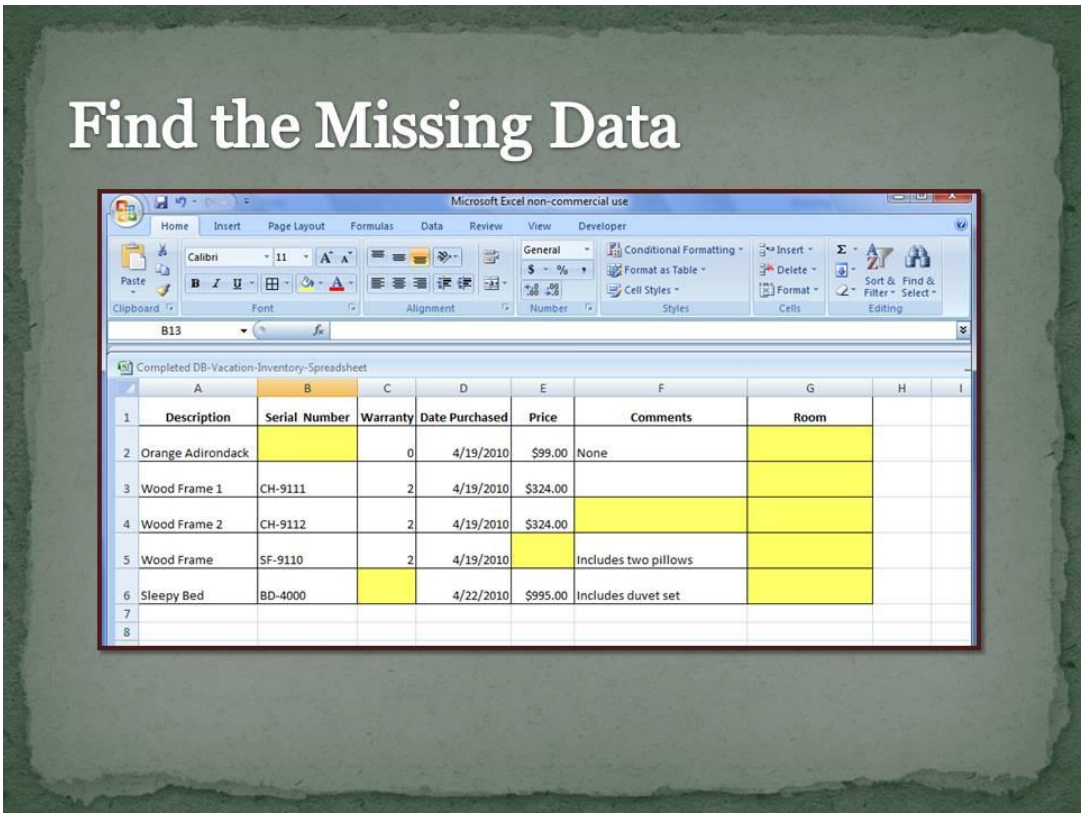
Appendix F


Database Concepts
in a Virtual World
Part Two A
Janet L. Ochs


Overview
Students utilize second home, DB Vacation Home, to add to the database
Students develop new table for Houses
Inventory database will contain three tables
Furniture
Rooms
Houses
Relate House Table to Room Table

Database Vacation Home
Second Life
Me Communicate World Build Help
DB Vacation Home, Nungu - Moderate
Favorites Bar
1 3 5
Welcome to Database (DB) Vacation Home
Database Scientist
TOUCH BOX FOR INSTRUCTIONS
Click here to chat.
Speak
Gesture
Move
View


Instructions to Add to the Database
Instructions for Database (DB) Vacation Home and the Inventory Database
Welcome to the DB Vacation Home. This is the second house used to create the inventory database. To enter the house, touch the door. After entering the house, find additional items for the inventory database. For the DB Vacation home, include data regarding the chairs, sofa and bed. To find information for the database fields, touch the items (such as the chairs) and when prompted, keep the "notecard". After clicking the keep button, the notecard should appear on your screen. The notecard contains the data needed for the different fields in the database.
In the database, you must relate the furniture to a specific room. Inside DB Vacation Home, there are 2 rooms (the great room and the upstairs bedroom). Remember to relate each piece of furniture to a specific room.
To speed up the data entry process, an excel spreadsheet is provided. The spreadsheet contains the data needed to finish creating the database. However, you must locate and fill in any missing data (highlighted in yellow on the spreadsheet). To open the spreadsheet, please select this link DB Vacation Home Inventory Spreadsheet.
After completing the spreadsheet and collecting the information for the database, answer the following questions:
• How will you relate each piece of furniture to a particular room?
• How will you relate each room to a specific house?
• How many tables are in your database?
• What are the primary and foreign keys?
When you are finished collecting the data about DB Vacation Home, you will need to complete the design of your database. When the database is completed, ensure that each piece of furniture in the database is related to a room (living room, great room, den, office, upstairs bedroom or bedroom) and to a specific house (DB Home or DB Vacation Home). The information needed for the houses is as follows:
• For DB Home, the House Name is DB Home, the House Type is A-Frame, the House Location is Snowbush and the House Owner is Database Engineer.
• For DB Vacation Home, the House Name is DB Vacation Home, the House Type is Modern, the House Location is Nungu and the House Owner is Database Scientist.

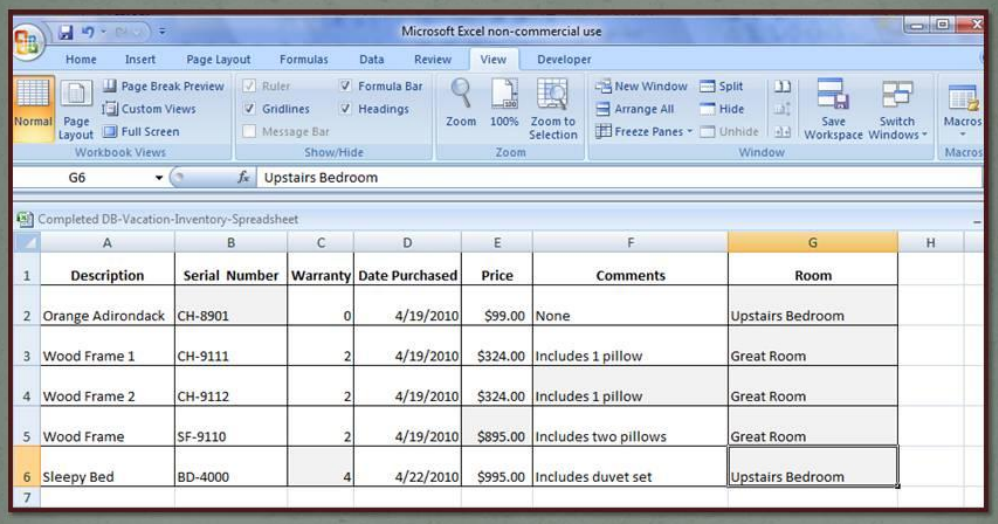


	Description	Serial Number	Warranty	Date Purchased	Price	Comments	Room
2	Orange Adirondack		0	4/19/2010	$99.00	None	
3	Wood Frame 1	CH-9111	2	4/19/2010	$324.00		
4	Wood Frame 2	CH-9112	2	4/19/2010	$324.00		
5	Wood Frame	SF-9110	2	4/19/2010		Includes two pillows	
6	Sleepy Bed	BD-4000		4/22/2010	$995.00	Includes duvet set	

Use Data to Update Spreadsheet
Second Life
Me Communicate World Build Help
DB Vacation Home, Nungu - Moderate
Favorites Bar
Notecard: Wood ...
Database Scientist
Description: Orange Adirondack Chair
Price: $99.00
Date Purchased: 4/19/2010
Serial Number: CH-8901
Warranty: 0 years
Gesture Move View

Gather Data From Each Room
Second Life
Me Communicate World Build Help
DB Vacation Home, Nungu - Moderate
Favorites Bar
Notecard: Wood ...
Database Scientist
Welcome to the Upstairs Bedroom

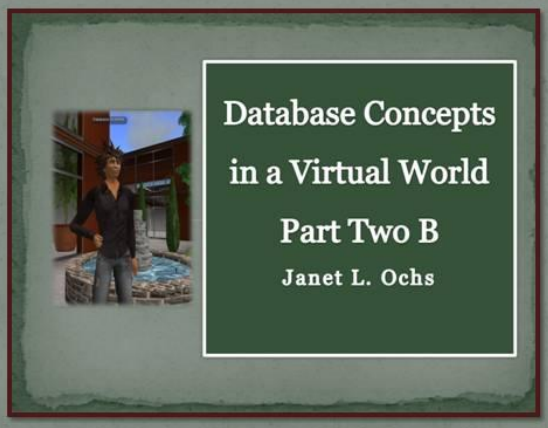
Complete the Spreadsheet



	A	B	C	D	E	F	G
1	Description	Serial Number	Warranty	Date Purchased	Price	Comments	Room
2	Orange Adirondack	CH-8901	0	4/19/2010	$99.00	None	Upstairs Bedroom
3	Wood Frame 1	CH-9111	2	4/19/2010	$324.00	Includes 1 pillow	Great Room
4	Wood Frame 2	CH-9112	2	4/19/2010	$324.00	Includes 1 pillow	Great Room
5	Wood Frame	SF-9110	2	4/19/2010	$895.00	Includes two pillows	Great Room
6	Sleepy Bed	BD-4000	4	4/22/2010	$995.00	Includes duvet set	Upstairs Bedroom
7							

Update the Inventory Database

- Edit database in Access and add information from DB Vacation Home as indicated in …

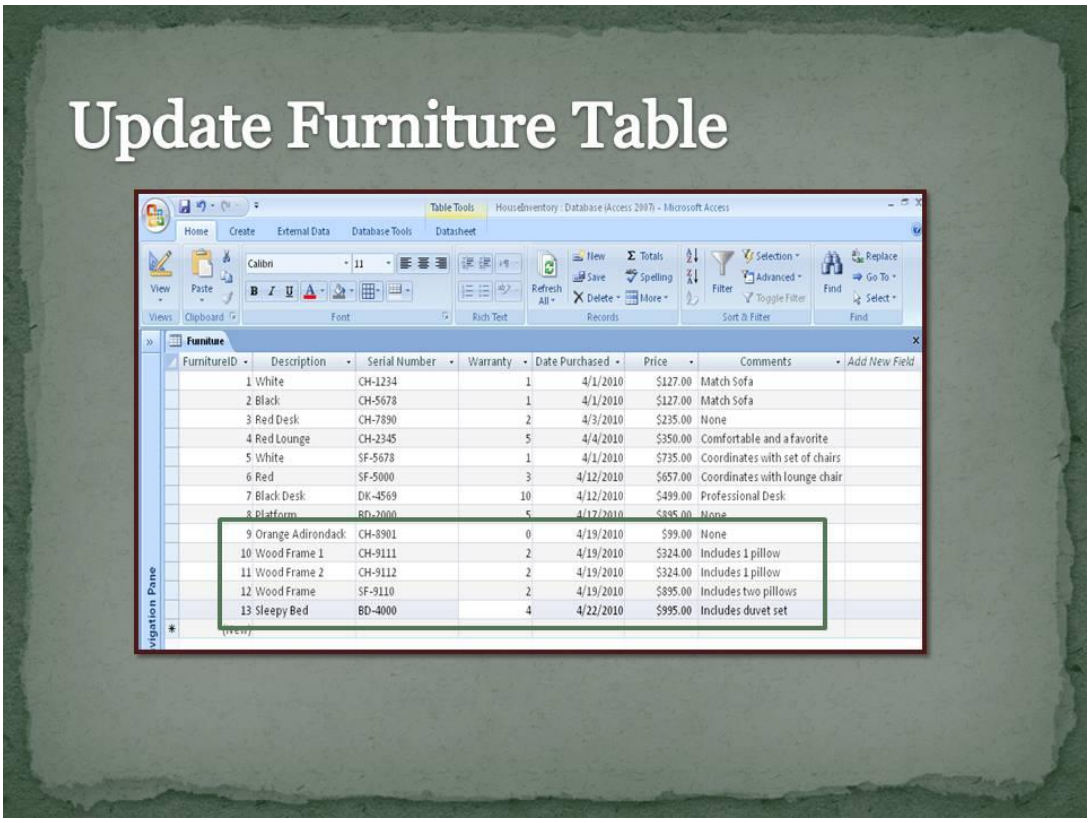


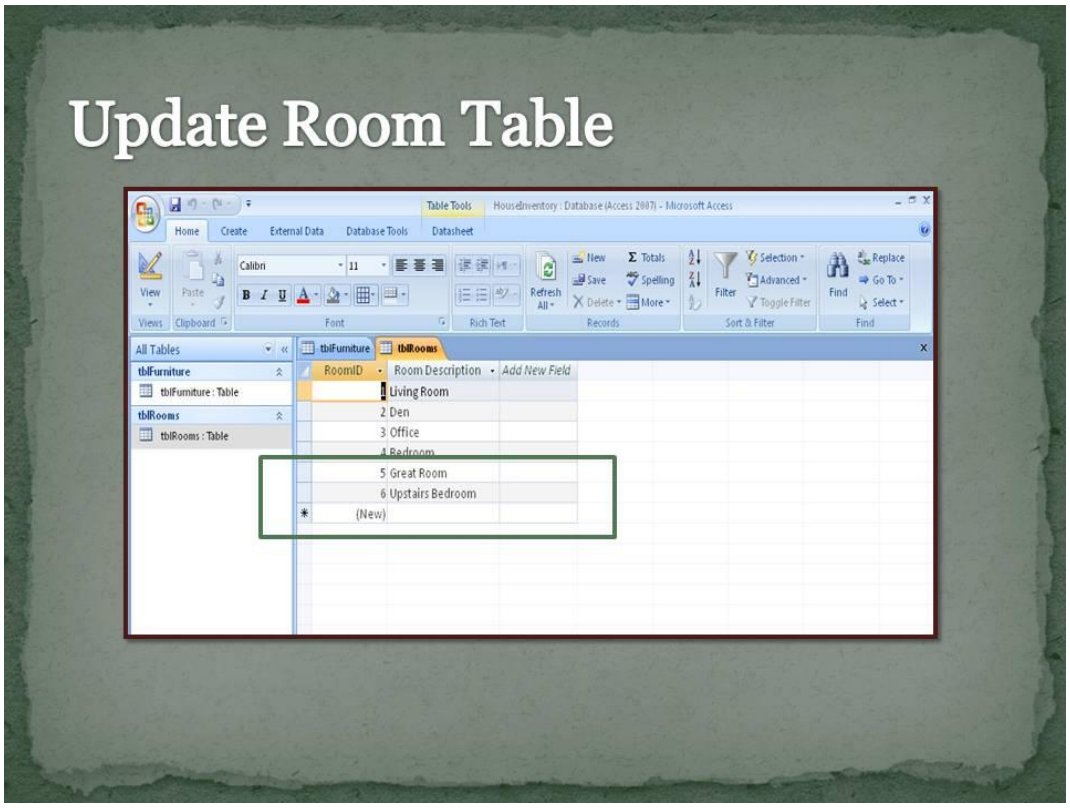
Database Concepts in a Virtual World Part Two B

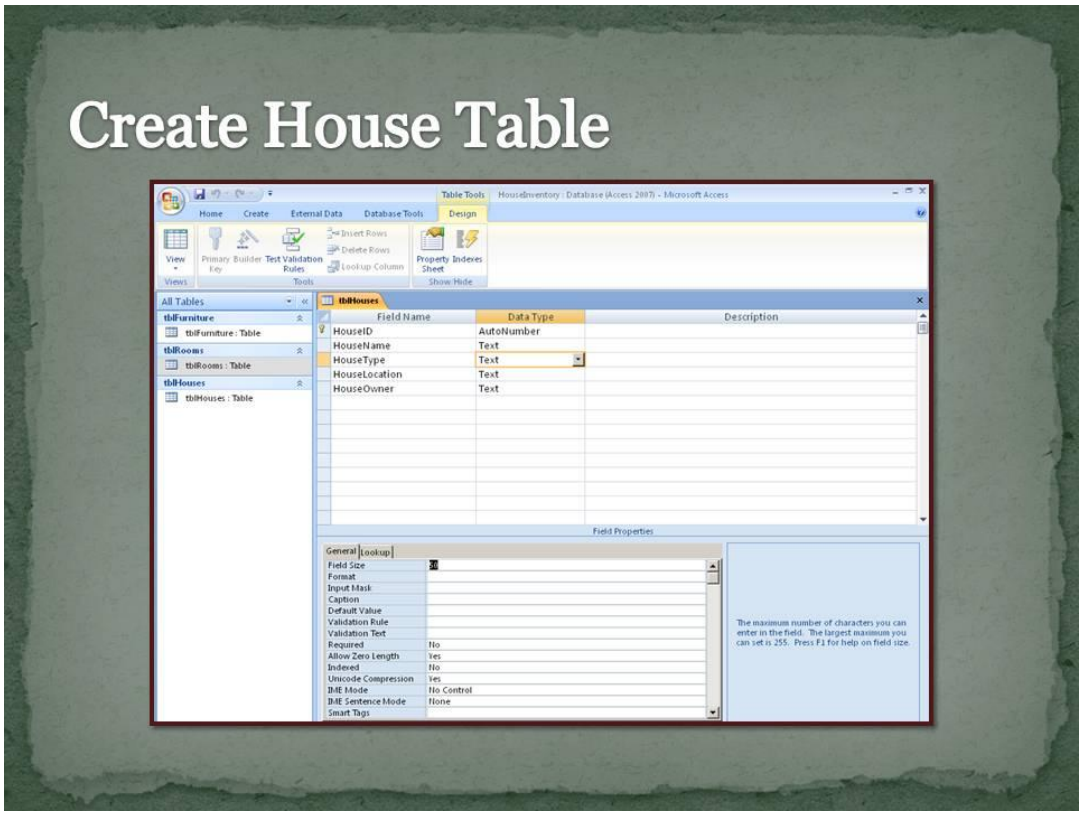
Janet L. Ochs

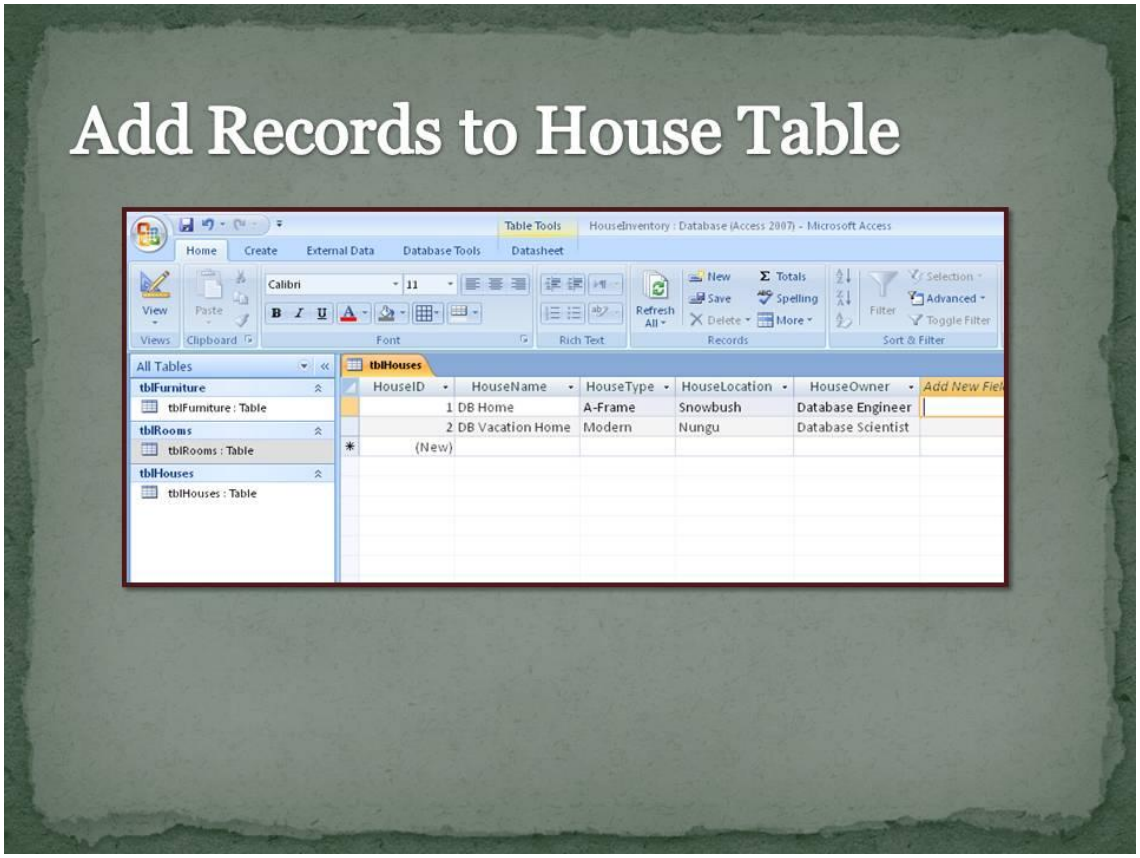
Overview of Access Steps

- Students utilize second home, DB Vacation Home, to add to the database
- Students develop new table for two Houses
- Inventory database contains three tables
  - Furniture - updated
  - Rooms - updated
  - Houses - new
- Relate House Table to Room Table

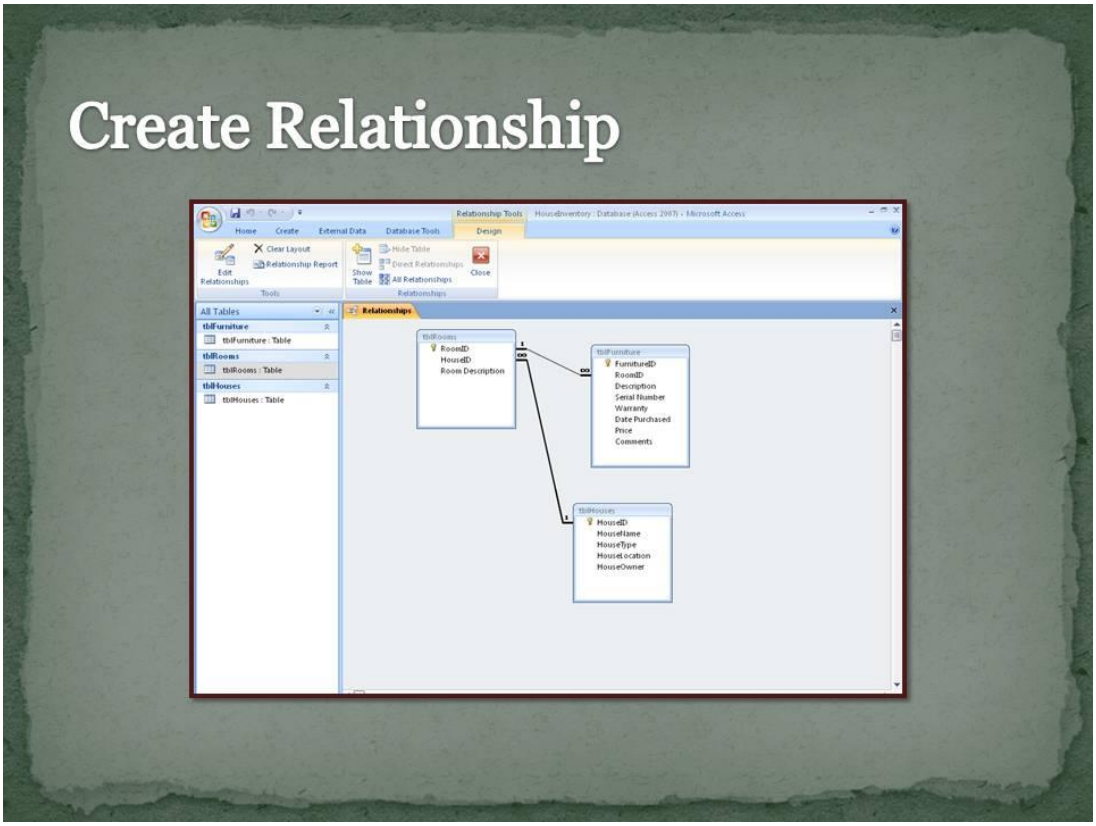

Update Furniture Table
Furniture
FurnitureID Description Serial Number Warranty Date Purchased Price Comments Add New Field
1 White CH-1234 1 4/1/2010 $127.00 Match Sofa
2 Black CH-5678 1 4/1/2010 $127.00 Match Sofa
3 Red Desk CH-7890 2 4/3/2010 $235.00 None
4 Red Lounge CH-2345 5 4/4/2010 $350.00 Comfortable and a favorite
5 White SF-5678 1 4/1/2010 $735.00 Coordinates with set of chairs
6 Red SF-5000 3 4/12/2010 $657.00 Coordinates with lounge chair
7 Black Desk DK-4569 10 4/12/2010 $499.00 Professional Desk
8 Platform BD-2000 5 4/17/2010 $895.00 None
9 Orange Adirondack CH-8901 0 4/19/2010 $99.00 None
10 Wood Frame 1 CH-9111 2 4/19/2010 $324.00 Includes 1 pillow
11 Wood Frame 2 CH-9112 2 4/19/2010 $324.00 Includes 1 pillow
12 Wood Frame SF-9110 2 4/19/2010 $895.00 Includes two pillows
13 Sleepy Bed BD-4000 4 4/22/2010 $995.00 Includes duvet set

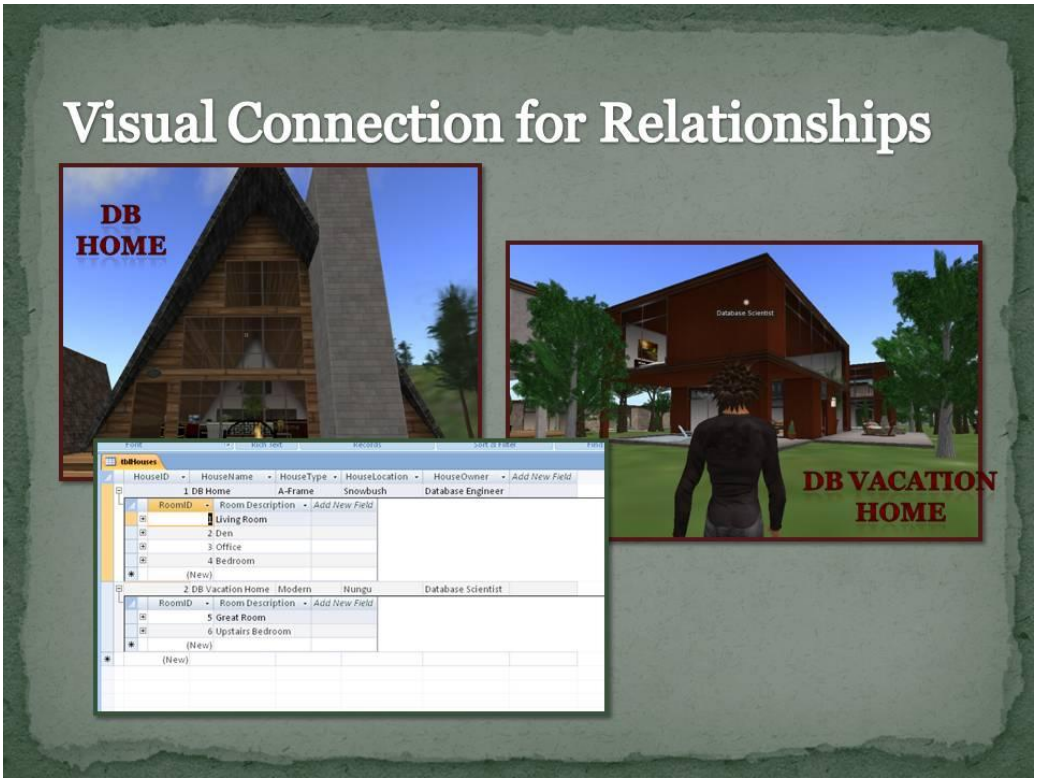

Update Room Table
All Tables
tblFurniture
tblFurniture : Table
tblRooms
tblRooms : Table
RoomID Room Description Add New Field
1 Living Room
2 Den
3 Office
4 Bedroom
5 Great Room
6 Upstairs Bedroom
(New)

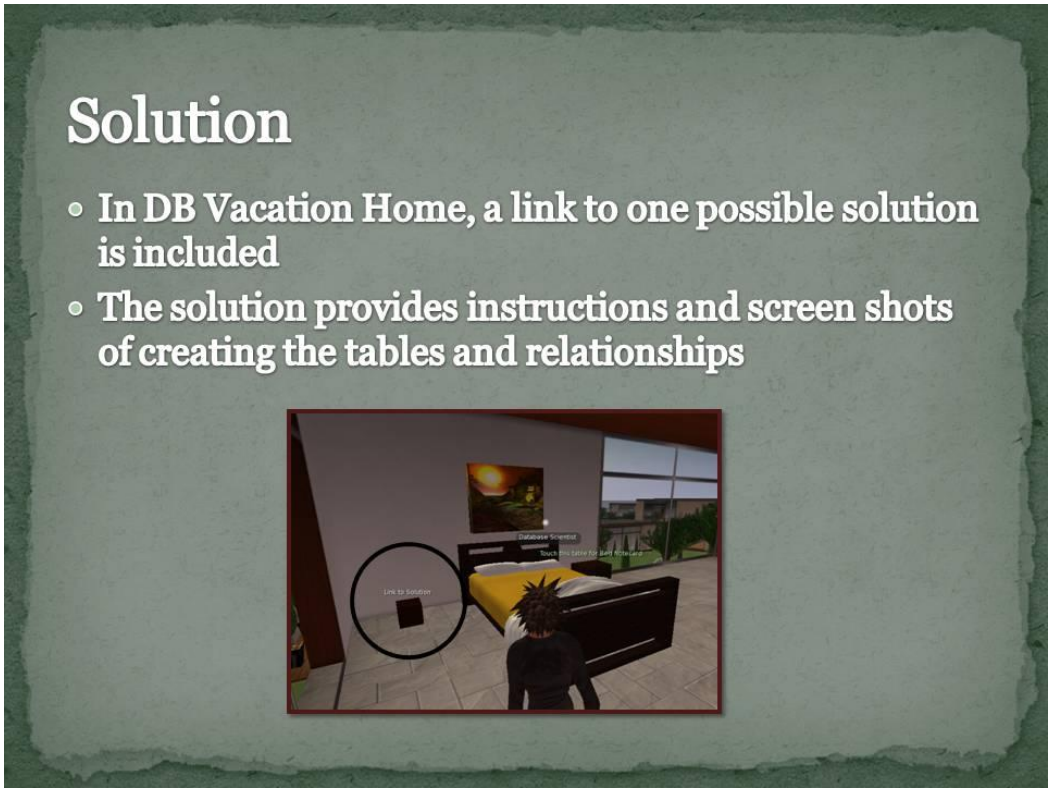

Create House Table
Table Tools
HouseInventory : Database (Access 2007) - Microsoft Access
Home
Create
External Data
Database Tools
Design
All Tables
tblFurniture
tblFurniture : Table
tblRooms
tblRooms : Table
tblHouses
tblHouses : Table
Field Name
Data Type
Description
HouseID
AutoNumber
HouseName
Text
HouseType
Text
HouseLocation
Text
HouseOwner
Text
Field Properties
General
Lookup
Field Size
Format
Input Mask
Caption
Default Value
Validation Rule
Validation Text
Required
No
Allow Zero Length
Yes
Indexed
No
Unicode Compression
Yes
IME Mode
No Control
IME Sentence Mode
None
Smart Tags
The maximum number of characters you can enter in the field. The largest maximum you can set is 255. Press F1 for help on field size.

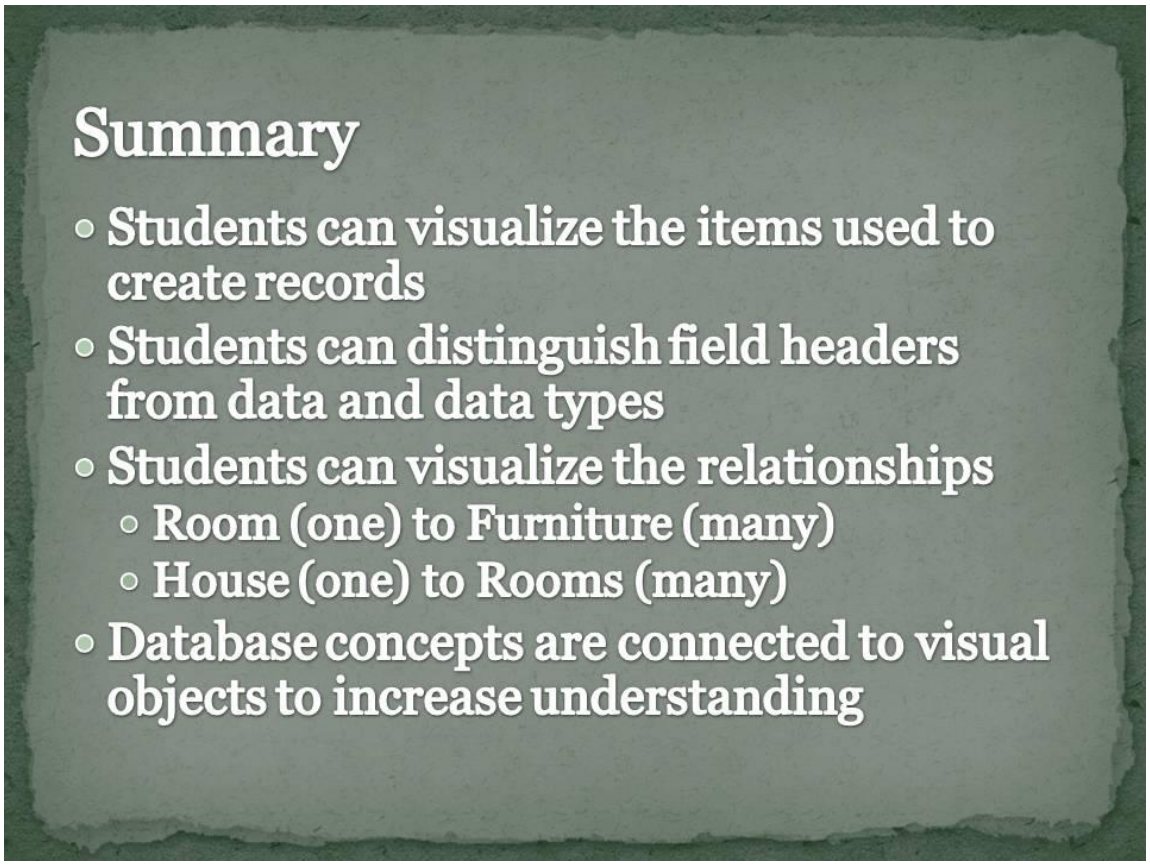

Add Records to House Table
Table Tools
HouseInventory : Database (Access 2007) - Microsoft Access
Home
Create
External Data
Database Tools
Datasheet
Calibri
11
Views
Clipboard
Font
Rich Text
Refresh All
New
Save
Delete
Totals
Spelling
More
Records
Filter
Selection
Advanced
Toggle Filter
Sort & Filter
All Tables
tblFurniture
tblFurniture : Table
tblRooms
tblRooms : Table
tblHouses
tblHouses : Table
HouseID
HouseName
HouseType
HouseLocation
HouseOwner
Add New Field
1 DB Home
A-Frame
Snowbush
Database Engineer
2 DB Vacation Home
Modern
Nungu
Database Scientist
(New)

Add Foreign Key to Room Table
Field Name
Data Type
Description
RoomID
AutoNumber
HouseID
Number
Room Description
Text


Create Relationship
Relationships


Visual Connection for Relationships
DB HOME
DB VACATION HOME
tblHouses
HouseID HouseName HouseType HouseLocation HouseOwner Add New Field
1 DB Home A-Frame Snowbush Database Engineer
RoomID Room Description Add New Field
1 Living Room
2 Den
3 Office
4 Bedroom
(New)
2 DB Vacation Home Modern Nungu Database Scientist
RoomID Room Description Add New Field
5 Great Room
6 Upstairs Bedroom
(New)
(New)

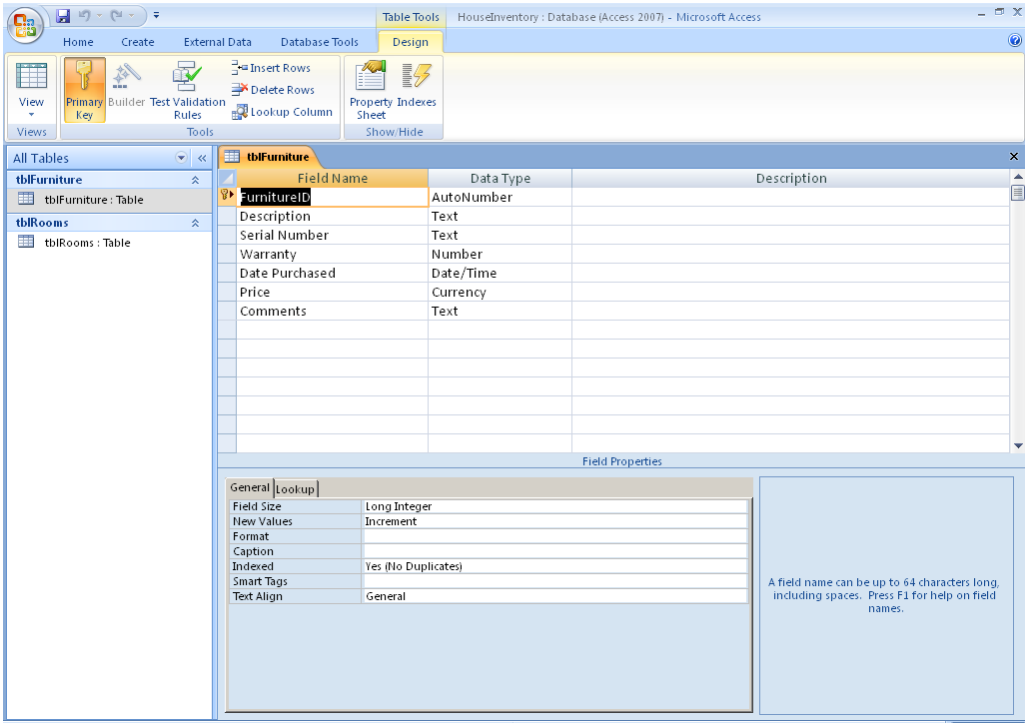

Solution
In DB Vacation Home, a link to one possible solution is included
The solution provides instructions and screen shots of creating the tables and relationships


Summary
Students can visualize the items used to create records
Students can distinguish field headers from data and data types
Students can visualize the relationships
Room (one) to Furniture (many)
House (one) to Rooms (many)
Database concepts are connected to visual objects to increase understanding

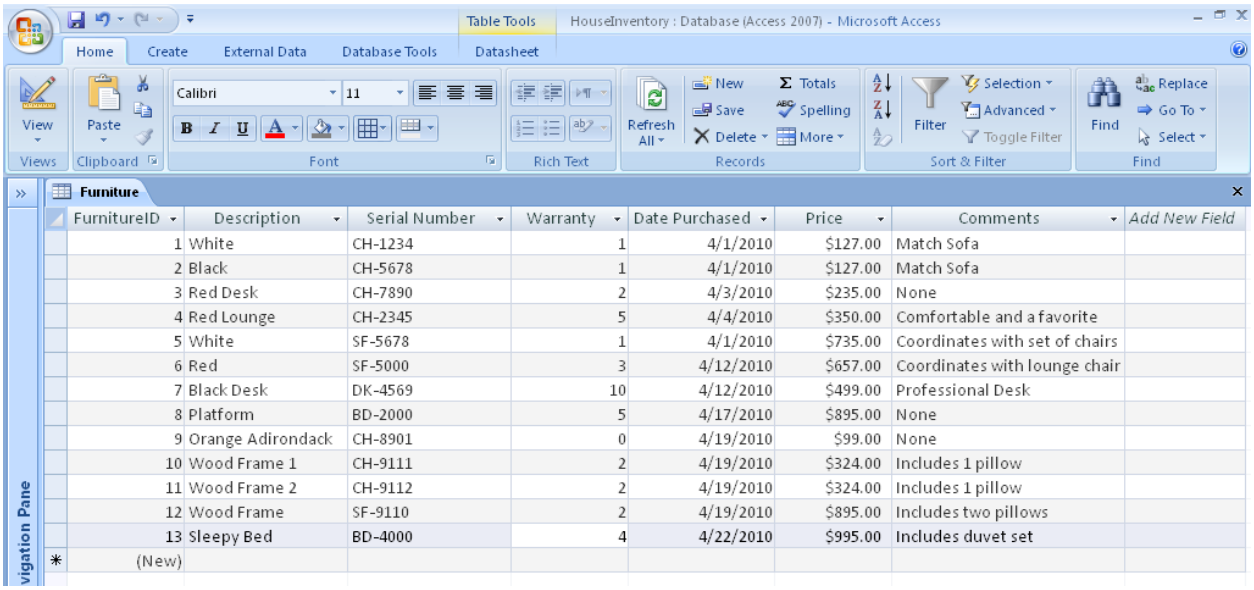
Appendix G

One Solution for the Inventory Database

1) Create a Furniture Table with a primary key of FurnitureID. Verify that your fields and data types are correct. The comment field can be text or memo. Remember to reduce your field sizes to an appropriate amount to save space.

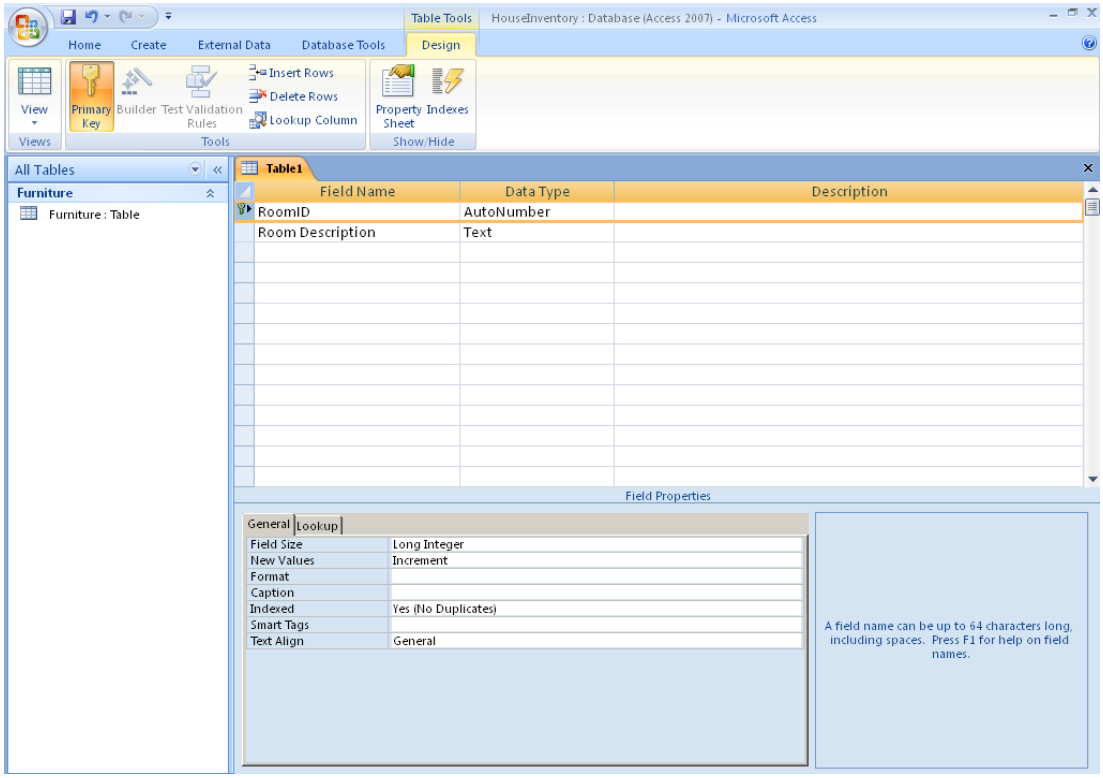


2) In Datasheet View, enter the furniture data from the spreadsheets. You may also use the external data option in Access to import the spreadsheets into the furniture table. Note: You can determine the furniture type based on the serial number. Chairs begin with CH, Sofas begin with SF, Desks begin with DK and Beds begin with BD.

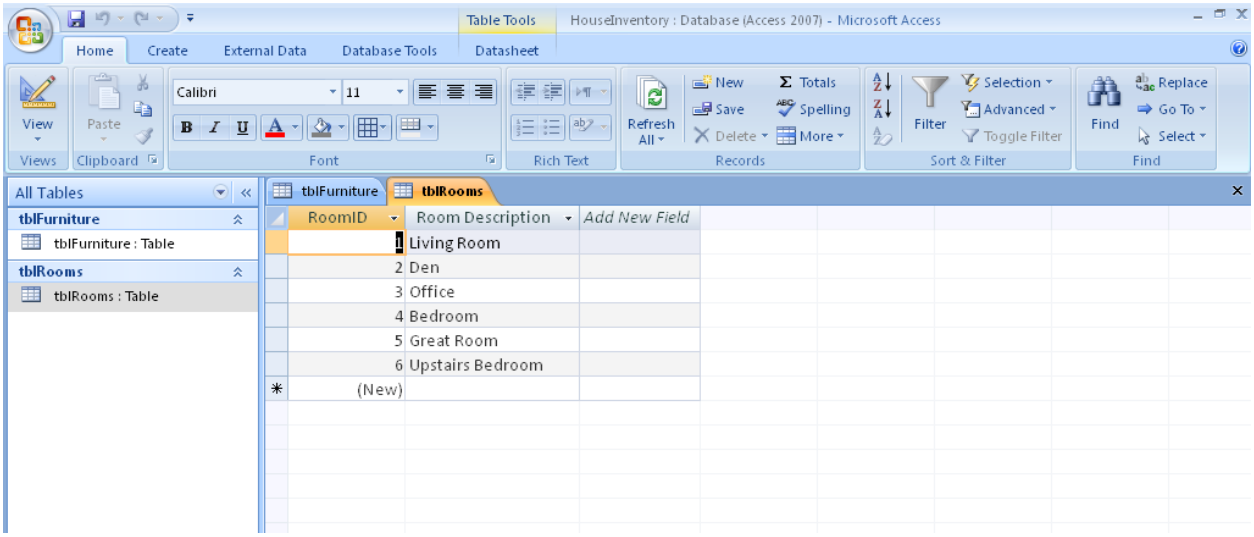


FurnitureID	Description	Serial Number	Warranty	Date Purchased	Price	Comments	Add New Field
1	White	CH-1234	1	4/1/2010	$127.00	Match Sofa	
2	Black	CH-5678	1	4/1/2010	$127.00	Match Sofa	
3	Red Desk	CH-7890	2	4/3/2010	$235.00	None	
4	Red Lounge	CH-2345	5	4/4/2010	$350.00	Comfortable and a favorite	
5	White	SF-5678	1	4/1/2010	$735.00	Coordinates with set of chairs	
6	Red	SF-5000	3	4/12/2010	$657.00	Coordinates with lounge chair	
7	Black Desk	DK-4569	10	4/12/2010	$499.00	Professional Desk	
8	Platform	BD-2000	5	4/17/2010	$895.00	None	
9	Orange Adirondack	CH-8901	0	4/19/2010	$99.00	None	
10	Wood Frame 1	CH-9111	2	4/19/2010	$324.00	Includes 1 pillow	
11	Wood Frame 2	CH-9112	2	4/19/2010	$324.00	Includes 1 pillow	
12	Wood Frame	SF-9110	2	4/19/2010	$895.00	Includes two pillows	
13	Sleepy Bed	BD-4000	4	4/22/2010	$995.00	Includes duvet set	
(New)							

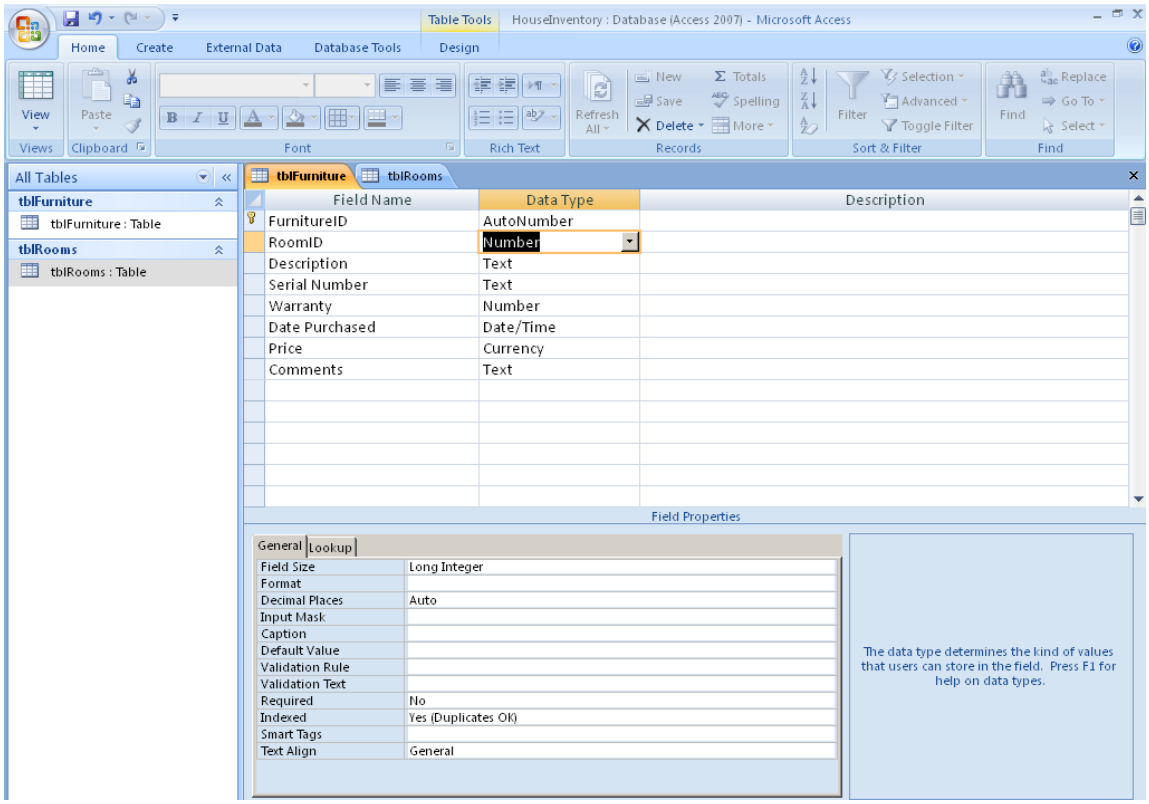
3) Create a Room Table and use RoomID as the primary key. Reduce the field size for the Room Description.



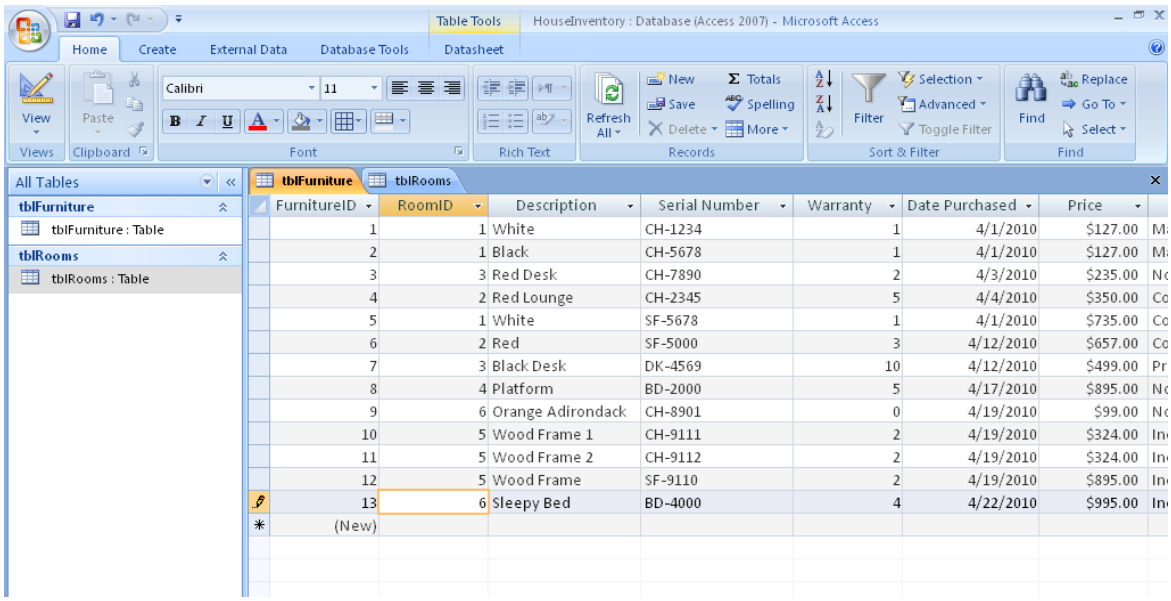
4) Add the room data (total of six rooms) to the Room Table in Datasheet View.



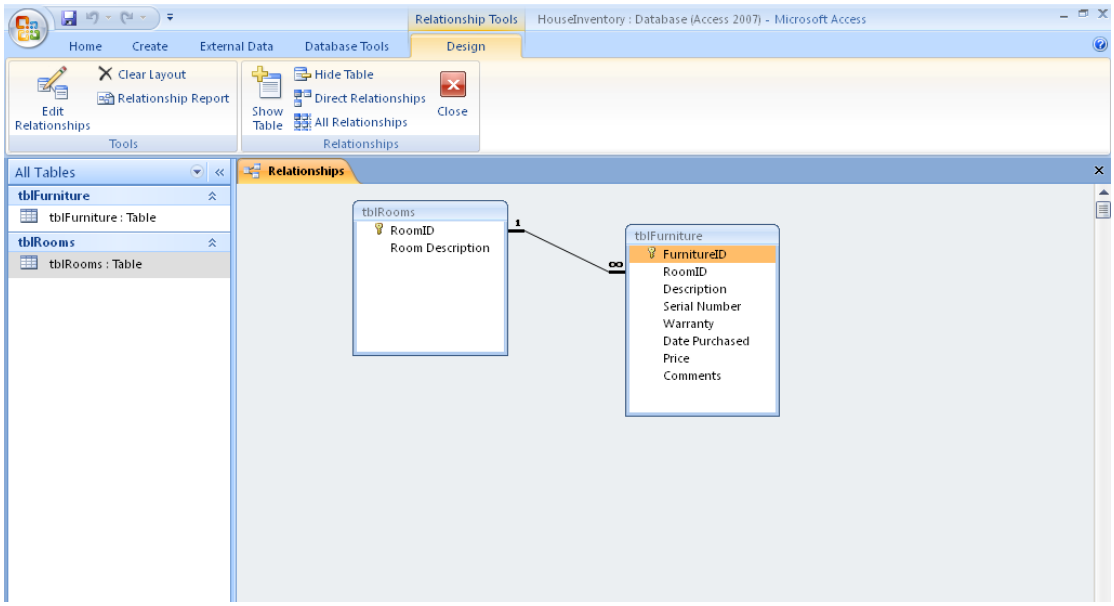
5) Create a relationship between the Furniture Table and the Room Table. First, add the RoomID field to the Furniture Table. The data type for RoomID should be number, NOT AutoNumber. For performance reasons, place the foreign key, RoomID, as the second field after the primary key, FurnitureID.



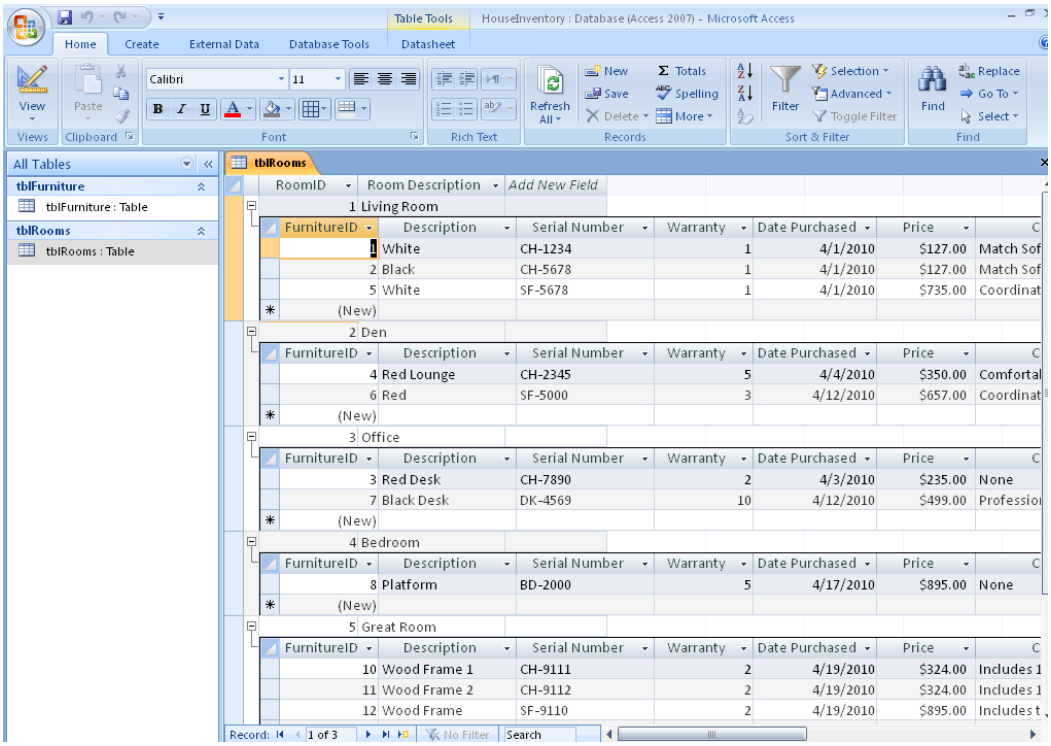
6) Second, update the Furniture Table in Datasheet View by adding the appropriate room number for each piece of furniture.



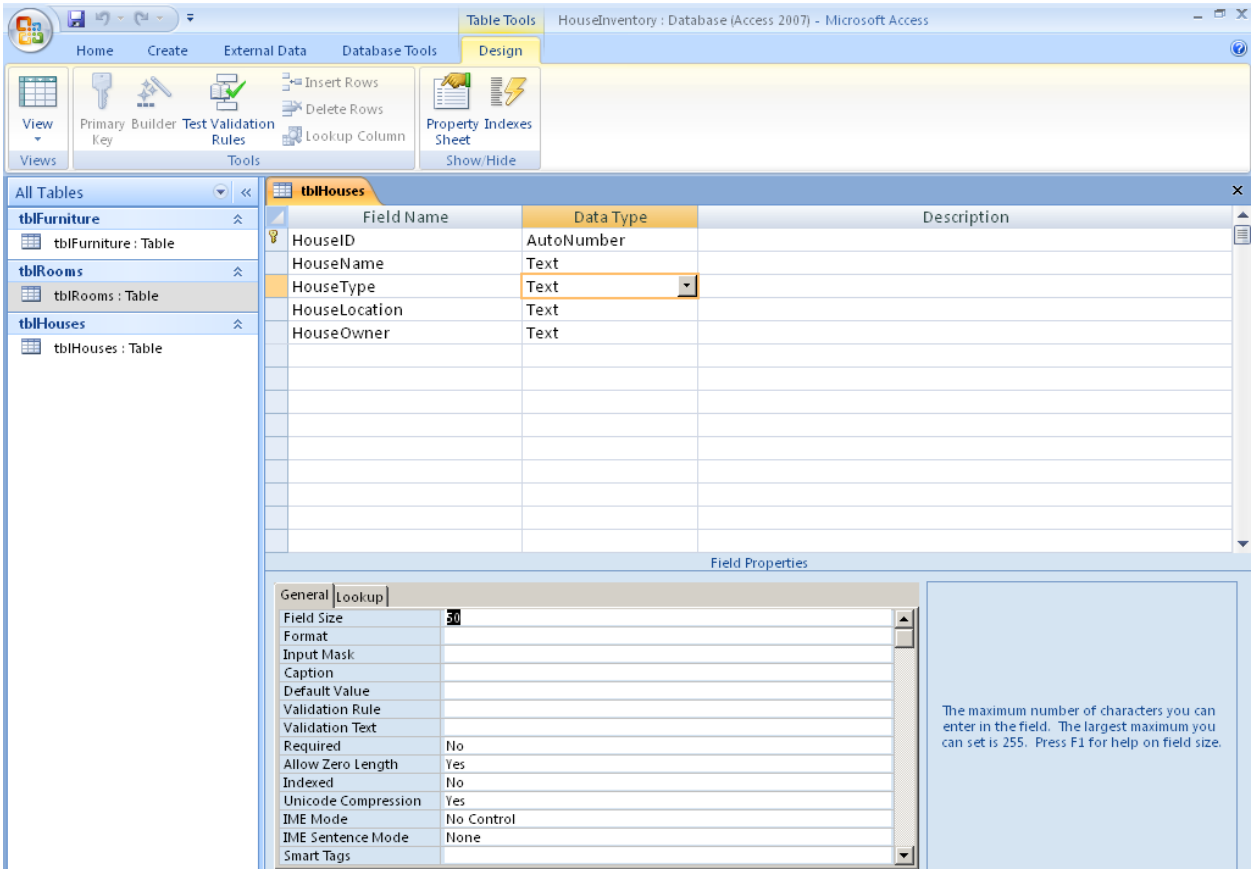
7) Third, create a relationship between the two tables using the relationship button. Drag the primary key, RoomID to the foreign key, RoomID in the Furniture Table. Enforce Referential Integrity.



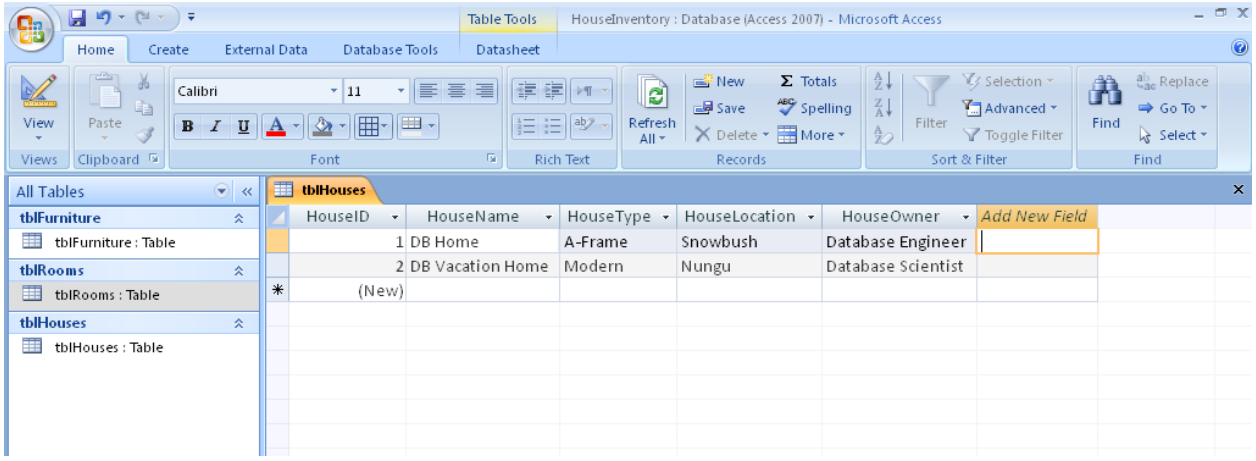
8) To display the results, open the Room Table and click on the plus signs for each room to show the relationships.



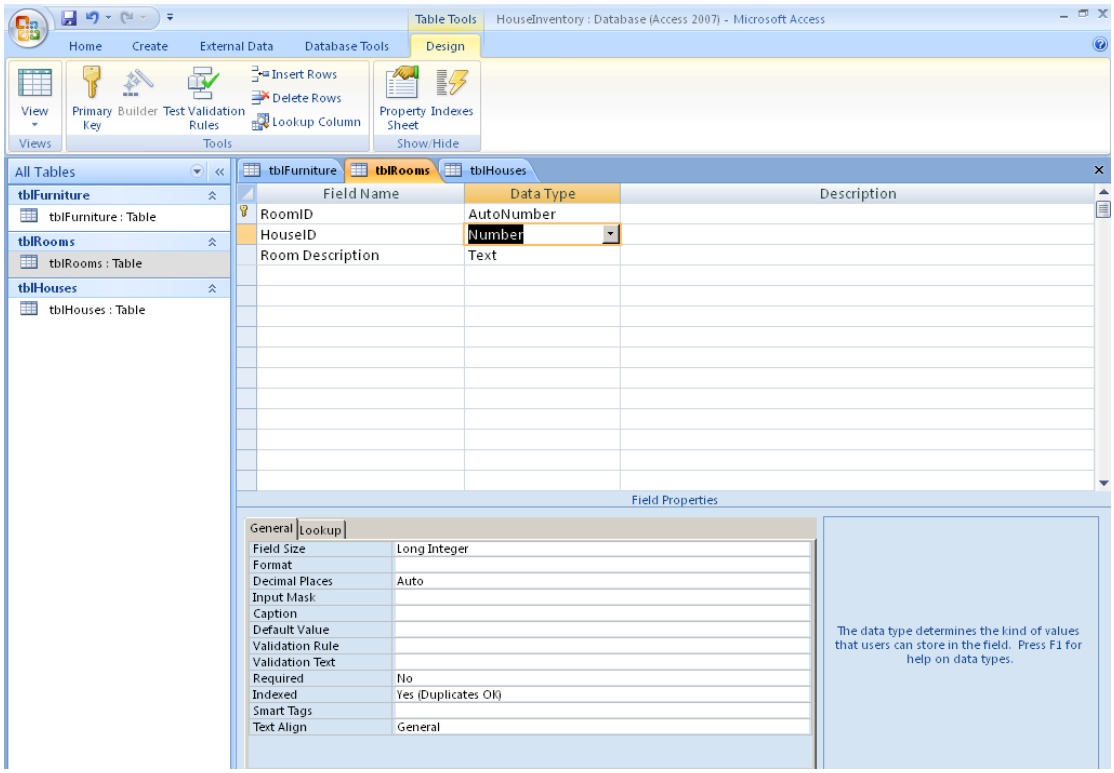
9) Create a House Table in Design View, to include data about DB Home and DB Vacation Home. Reduce the field size for each text field.



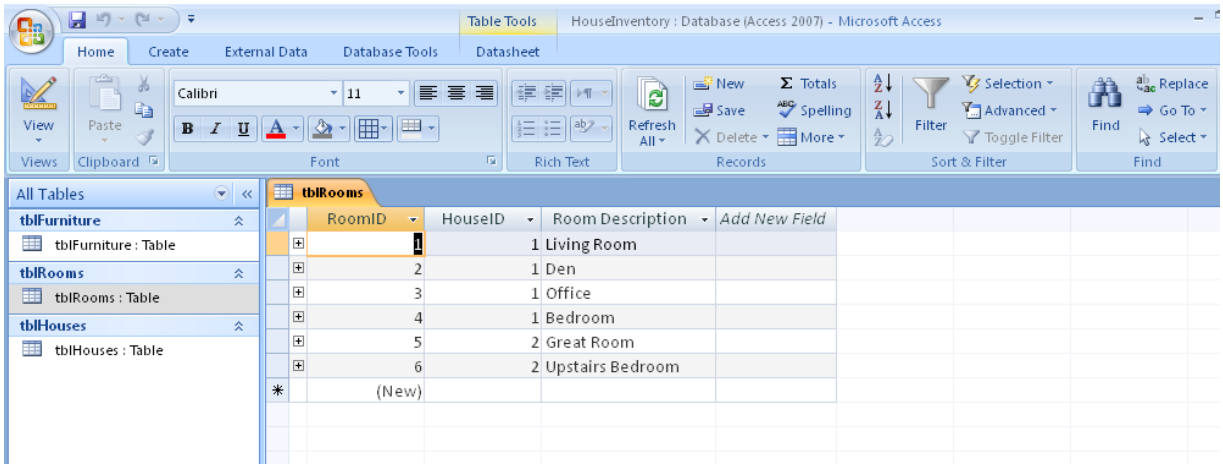
10) In DataSheet View, add the records about DB Home and DB Vacation Home.



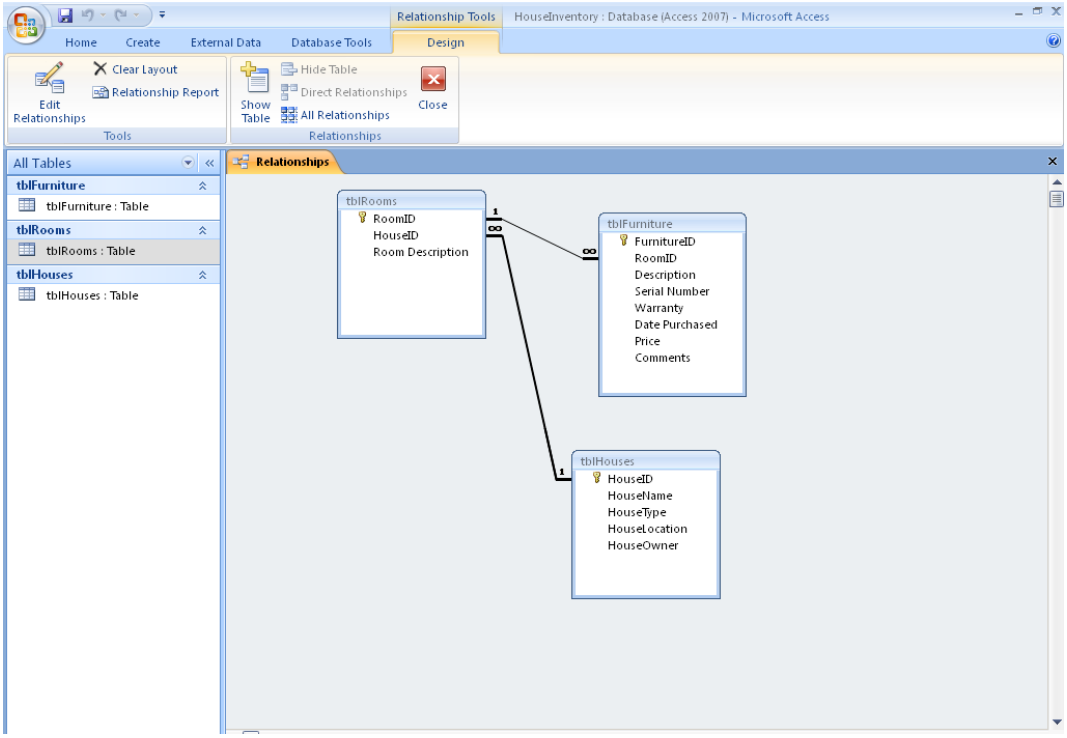
11) To create a relationship between the Room Table and the House Table, add HouseID with a data type of Number to the Rooms Table.



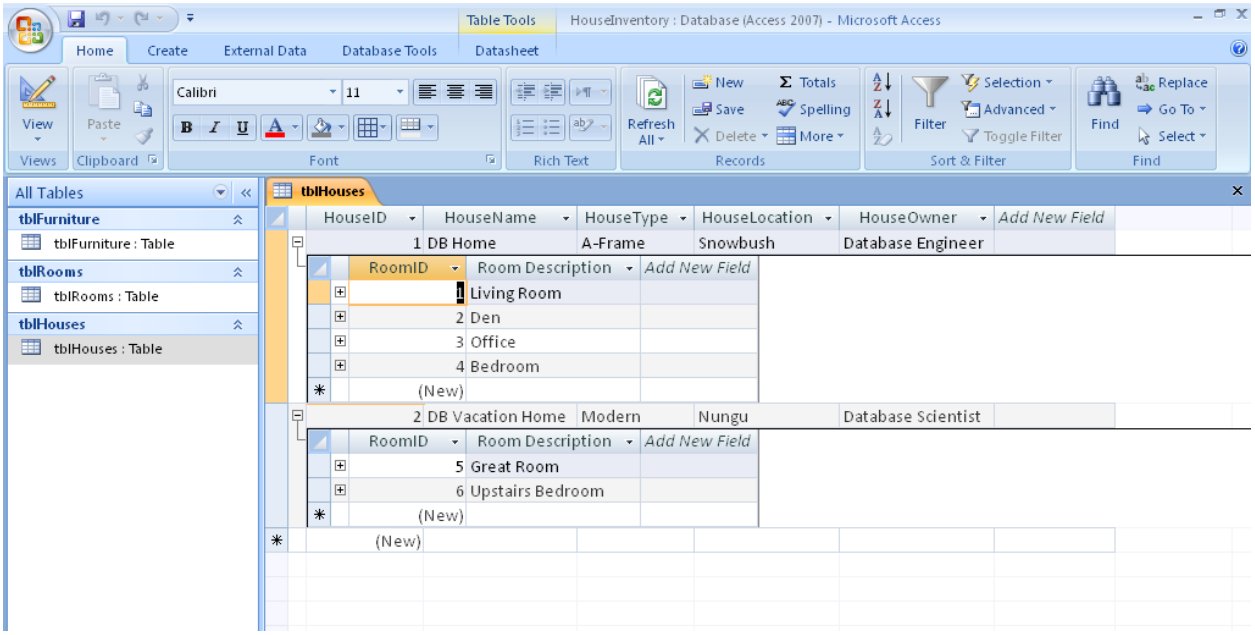
12) In Datasheet View of the Rooms Table, add the appropriate house number for every room.



13) Using the relationship button, create a relationship between the House Table and the Rooms Table using HouseID to relate the tables. Enforce Referential Integrity.



14) Open the House table to see the rooms related to DB Home and DB Vacation Home.



Annotated Bibliography

Adams, E. S., Granger, M., Goelman, D., and Ricardo, C. 2004. Managing the introductory database course: what goes in and what comes out?. In *Proceedings of the 35th SIGCSE Technical Symposium on Computer Science Education* (Norfolk, Virginia, USA, March 03 - 07, 2004). SIGCSE '04. ACM, New York, NY, 497-498. DOI= http://doi.acm.org/10.1145/971300.971467

Adams, Granger, Goelman and Ricardo (2004) explain the current status of introductory database courses. The authors' state "it appears that topics are constantly added, but none disappear." Adams, Granger, Goelman and Ricardo (2004) argue that the database module is the most important part of the computer science curriculum and claim organizations spend 10 billion purchasing database software each year. In the article, faculty experiences regarding their introductory database courses are recorded and curriculum recommendations are made.

Agrawal, R., Ailamaki, A., Bernstein, P. A., Brewer, E. A., Carey, M. J., Chaudhuri, S., Doan, A., Florescu, D., Franklin, M. J., Garcia-Molina, H., Gehrke, J., Gruenwald, L., Haas, L. M., Halevy, A. Y., Hellerstein, J. M., Ioannidis, Y. E., Korth, H. F., Kossmann, D., Madden, S., Magoulas, R., Ooi, B. C., O'Reilly, T., Ramakrishnan, R., Sarawagi, S., Stonebraker, M., Szalay, A. S., and Weikum, G. 2009. The Claremont report on database research. *Commun. ACM* 52, 6 (Jun. 2009), 56-65. DOI= http://doi.acm.org/10.1145/1516046.1516062

Over the past 20 years at seven separate meetings, a group of database professionals got together to examine trends for database research. At the meeting held in 2008, the authors of *The Claremont report on database research* determined that the exciting new areas for research were "big data", "data analysis as a profit center", "architectural shifts in computing", mobile applications, "cloud data services" and virtual worlds. This article is relevant because it highlights the rapid changes in the database field.

Bagui, S. and Haar, L. T. (2009). Database education in the new millenium. *J. Comput. Small Coll.* 24, 4 (Apr. 2009), 80-87.

Bagui and Ter Harr (2009) provide the most comprehensive review of both the history of the database curriculum and its current status. In their article, the authors review what other colleagues are doing and survey industry experts to document industry requirements. The authors (2009) summarize "two major model curricula, IS2002 and the ACM/IEEE CC2005" in two separate tables. Bagui and Ter Harr (2009) also map the model curricula to actual database courses such as Advanced Database Systems, Database Administration and Data Warehousing. Bagui and Ter Harr (2009) explain that educators "have to cover not only a lot more database topics, but also cover them in greater depth and breath, and since we are limited to 120 hours of curriculum space, we have to come up with new ways of offering the database courses." Bagui and Ter Harr (2009) propose repackaging database courses by offering database certificates and recommend looking at new degree programs for the database area.

Clavering, R. S. and Nicols, A. R. 2007. Lessons learned implementing an educational system in Second Life. In *Proceedings of the 21st British HCI Group Annual Conference on HCI 2008: People and Computers Xxi: Hci..But Not As We Know It - Volume 2* (University of Lancaster, United Kingdom, September 03 - 07, 2007). British Computer Society Conference on Human-Computer Interaction. British Computer Society, Swinton, UK, 19-22.

Clavering and Nicols (2007) investigated using 3-D virtual environments for learning and experienced some difficulties. Clavering and Nicols (2007) claim the product they used, Second Life, lacked documentation and enforced strict limits on resources such as memory. Clavering and Nicols (2007) found implementing Second Life while learning the software to be rather challenging. Clavering and Nicols (2007) experienced slow response times using the product and stated "the range of truly worthwhile educational applications of Second Life remains an open question."

Gollub, R. 2007. Second life and education. *Crossroads* 14, 1 (Sep. 2007), 1-8. DOI= http://doi.acm.org/10.1145/1349332.1349334

Gollub (2007) examines how educational institutions are using a 3-D virtual world, Second Life, and describes some of its advantages. Gollub (2007) claims a "professor can illustrate points visually as well as verbally with minimum effort." According to Gollub (2007), the most common educational use for Second Life is teaching classes and building libraries. For example, Gollub (2007) explains that "to teach a class in the virtual Second Life world, referred to as

inworld", faculty are "renting or buying spaces, buying or building models of the subject they intend to teach, and inviting the class to meet partially or entirely in Second Life."

Jeffers, D. 2008. Is there a second life in your future?. In Proceedings of the 36th Annual ACM SIGUCCS Conference on User Services Conference (Portland, OR, USA, October 19 - 22, 2008). SIGUCCS '08. ACM, New York, NY, 187-190. DOI= http://doi.acm.org/10.1145/1449956.1450012

Jeffers (2008), a member of IT User Services at the University of Delaware, documents several considerations for using 3-D environments in Second Life. Jeffers (2008) explains that there is a learning curve for working with the new software and time is required for figuring out the navigation features of Second Life. Jeffers (2008) recommends 40 hours of upfront training time and suggests being realistic about "those blazing the trail for your institution." Jeffers (2008) lists numerous examples of faculty projects and states "when the technology is a good match for a course, we are encouraging more faculty members to give this virtual world a try."

Joint Task Force for Computing Curricula (2005) A cooperative project of The Association for Computing Machinery (ACM) The Association for Information Systems (AIS) The Computer Society (IEEE-CS) 30 September 2005 Retrieved July 17, 2009 from http://www.acm.org/education/curric_vols/CC2005-March06Final.pdf

The Joint Task Force for Computing Curricula (2005) explains that it is difficult to update computing programs for students because the field changes so rapidly. The Joint Task Force

(2005) claims that educational institutions are slow to act and fail to make program changes quickly.

Murray, M. and Guimaraes, M. 2008. Expanding the database curriculum. *J. Comput. Small Coll.* 23, 3 (Jan. 2008), 69-75.

Murray and Guimaraes (2008), NSF grant recipients, state that "while a set of commonly identified core concepts and principles exists, there is little consensus on what supplemental materials should be included in database courses." Murray and Guimaraes (2008) create an instructional tool using "animations to deepen and enrich standard presentations of core database concepts and to complement database teachings as found in the most popular texts." Murray and Guimaraes (2008) develop the animations to cover database topics more efficiently. The article is important because it proposes using an instructional tool to improve database course content delivery as opposed to using more traditional methods.

Ritzema, T. and Harris, B. 2008. The use of Second Life for distance education. J. Comput. Small Coll. 23, 6 (Jun. 2008), 110-116.

Ritzema and Harris (2008) implemented Second Life, a 3-D instructional tool, at the University of Tennessee with positive results. The authors found that 83% of the computer science students surveyed wanted to see an increase in the amount of Second Life usage. However, Ritzema and Harris (2008) warned that "the amount of preparation time in setting up user accounts, in-world property, objects, and videos can be substantial." The authors recommended purchasing

prefabricated “buildings and objects from vendors within Second Life to eliminate this problem”. Ritzema and Harris (2008) concluded their article by listing a number of recommendations for faculty members interested in working with Second Life. The article is pertinent because it demonstrates that Second Life can be incorporated within a computer science program.

Second Life Education Wiki (2009) Educational Uses of Second Life Resource Retrieved August 13, 2009 from http://sleducation.wikispaces.com/educationaluses

The Second Life wiki lists over one hundred case studies for education. The case studies provide brief descriptions of projects and display a sample image for each. The wiki provides numerous examples of how to use Second Life for instructional purposes and tracks the “Top 20” educational locations.

Wagner, P. 2005. Teaching data modeling: process and patterns. In Proceedings of the 10th Annual SIGCSE Conference on innovation and Technology in Computer Science Education (Caparica, Portugal, June 27 - 29, 2005). ITiCSE '05. ACM, New York, NY, 168-172. DOI= http://doi.acm.org/10.1145/1067445.1067493

Wagner (2005) supports the notion that room in the database curriculum is “scarce”. However, this author proposes increasing the amount of time spent on “higher level skills” such as data modeling as a possible solution.