Northeastern University College of Computer and Information Science

CS1100: Computer Science and Its Applications

Course Introduction

CS1100 Computer Science and its Applications

- The course focuses on data:
 - how data may be organized
 - how useful information may be extracted from data
 - how summary information may be calculated
 - methodical and analytical problem solving techniques
- You will learn how to do simple but very effective computations using Microsoft Excel and Access.
- While a single course cannot cover all aspects of these software tools, you will nevertheless learn important highlights.

Learning Objectives

- Upon completion of this course, students will know how to:
 - conceptualize and solve problems involving the analysis of data
 - calculate elementary statistics and present data analyses in Excel
 - build charts and graphs in Excel
 - design relational databases and formulate queries in Access
 - construct reports in Access

Course Topics

Excel (Spreadsheet)

- Cells contain either Values or Formulas
- Cell references, named ranges
- Assume Given Data for a problem may change
- Copying and Dragging with Fill Handle
- Absolute and Relative Addressing
- IF function
- Partitioning data into subsets
- Math functions, counting
- Lookup tables VLOOKUP
- Solving inductively defined problems
- Text manipulation and processing
- Formatting vs. rounding
- Charts and Graphs

Access (Database)

- Relational databases
- Tables, rows, columns, values
- Table Predicates
- Queries
- Selecting Rows
- Projecting Columns
- Duplicates, Uniqueness and Counting entities
- Joining Tables
- Database Keys
- Unrelated Tables
- Subqueries
- Reports

Course Web Site

- http://www.ccs.neu.edu/course/cs1100f13
 Also linked from Blackboard
- Course Materials
 - Excel Tutorials
 - Access Tutorials
 - PPT Slides
- Blackboard:
 - Submit Labs, Quizzes, Tests
 - Grades

Communication

- Communication through Blackboard's email feature
 - Be sure your Blackboard email address is correct and that you check it often
- Piazza Discussion Group

- Anonymous posts are fine.

Grading & Assessment

Assessment	Grade %
Excel Quiz	10%
Excel Test	25%
Access Quiz	10%
Access Test	25%
Lecture Quizzes	5%
Excel Final (optional)	Average with Excel Test
Access Final (optional)	Average with Access Test
Excel Labs (5)	12.5%
Access Labs (5)	12.5%
Lab 0	Mandatory, but 0%

• A better test grade replaces a lower quiz grade.

Course Format

- There are two class sessions per week, all held in the computer lab, WVH 210.
- Class sessions alternate between lecture/discussion of the material, and time to work on lab assignments.
- Lectures will end with a very short quiz. Lecture quizzes are worth 5% of your final grade.
- Attendance in lab sections is optional if all lab assignments due to that point have been submitted.
 - I.E. You may leave (quietly, please) when you are done.
 - You may miss additional explanation/clarification of previously discussed material, but never new material.

Lab Assignments

- Labs are intended to reinforce and deepen your study of the covered material
- You are expected to not only study the provided resources, but investigate additional resources
- Labs are to be completed individually
- Late submissions are subject to penalties

Late Submissions

- 20 percentage points will be deducted per late day from assignments which are submitted after the due date.
- The only exception is a valid medical excuse accompanied by a physician's note.

General Principles

- Assume Your Data May Change!
 - It is best practice when creating spreadsheets or writing database queries to assume that the given data for a problem might change.

General Principles

- Don't Duplicate Given Data!
 - Since the given data for a problem may change, this data should appear in one place only.
 - If data given for a problem is repeated in many places, then changing that data will require changes in many places.
 - This can be a source of errors as well as a source of unnecessary work.

General Principles

- Ask the Right Question!
 - Make sure your formulas will not only work for this data set, but they will work for ANY data set.
 - If the data changes, the answer should be correct for the new data set.

A Trivial Example

- Here is a simple problem to illustrate the concept of "Ask the Right Question"
 - -You are asked to find the sum of the following numbers: 2, 5, 7, 8

Bad Solution

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What's wrong?

- Cell A6 has the correct answer, i.e. 22
- However, notice the formula box contains the number 22.
- This means that the answer 22 is "hard-coded" in the selected cell. (Hard-coding a correct answer is worth fewer points than a formula that gives an incorrect answer.)
- If one of the given data cells changed, say A1 was changed from 2 to 3, then the spreadsheet would look like this:

Changed Data / Incorrect Answer



Changed Data/ Incorrect Answer

- The spreadsheet now appears to say that the sum of 3, 5, 7 and 8 is 22
- This is the wrong answer, but the error is not obvious without careful inspection.

Another Bad Solution



What's wrong?

- In this example, cell A6 again shows the correct answer.
- Also the formula box shows that A6 contains a formula for the answer, and not the number 22 itself
- However, the formula in cell A6 repeats the data that appears in cells A1 – A4
- If the value in cell A1 were changed to 3, then the sum would again be incorrect

A Third Bad Solution



What's wrong?

- In this example:
 - Cell A6 shows the correct value
 - Cell A6 has a formula not a hard-coded value
 - The formula does not repeat any data
- But:
 - The formula does not solve the problem of finding the sum of the cells A1 – A4, and only accidentally gives the right answer

The Problem Solved "Right"



The Fix

- Notice that the formula box now contains a formula for calculating the sum
- If one of the cells containing given data changes, the cell containing the answer will change appropriately.

General Principle

• Decompose Complex Problems!

Example:

- You given the initial balance of a loan, a monthly interest rate for that loan, and a standard monthly payment amount.
- On the last month, only the remaining balance is paid
- You are asked to calculate the balance owed at the end of each month.

A Monolithic Solution

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Breaking the Problem into Smaller Parts

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7					5	\$3.09	\$620.24	\$100.00	\$520.24	
8					6	\$2.60	\$522.84	\$100.00	\$422.84	
9					7	\$2.11	\$424.95	\$100.00	\$324.95	
10					8	\$1.62	\$326.57	\$100.00	\$226.57	
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Comparison

- The Monolithic solution calculates the monthly balance with one complex formula
- The Solution with intermediate results, performs the same calculation by breaking up the complex formula into three simpler formulas.

Dividing the solution into smaller parts has advantages

- 1. It is easier to catch mistakes
 - There are more results that can be checked
- 2. It is easier to verify correctness
 - Verification can be done step by step
- 3. It is easier to reuse the parts
 - Say you are asked to find the total amount paid for the loan, it would be easier to make the necessary changes