CLA CS-101 (A1)
Introduction to Computers
Spring 1995

Review

1 In class we considered a number of computer programs, namely graphic editors, word-processors, spreadsheets, and databases. Such programs are similar in that all of them can be viewed as information processors. They are different, however, in their processing capabilities. An important decision to be made before investing one's time and money is to study the application at hand and decide which program would be more appropriate to use.[a] The following is a list of possible operations/tasks that one can use computers to accomplish. For each one of these operations/tasks: give a **definition** of the operation, **associate** it with one of the four programs mentioned above (graphic editors, word-processors, spreadsheets, and databases), and give an **example** of its use.

What-if Analysis.
Free-hand illustrations.
Spelling check.
Browsing.
Typesetting.
Graphing.

[a] In many instances one program won't be enough and a combination of programs must be used to tackle various aspects of the application at hand.

2 Answer the following questions:

1. A database relation that consists of 100,000 records is to be modified by adding a new 20-character field. How many more bytes will be needed to store the extra information?
2. When creating a relational database, the most important decision is the identification of those entities of a given record that would make sense to isolate in separate fields. When would it be appropriate to separate data into a number of fields? Use examples like whether one should enter Names as Firstnames and Lastnames or just as Fullnames, or whether one should separate the State and Zip code information in different fields or not.
3. Explain briefly what is meant by the "problem of circular reference" in spreadsheets. Why is such a practice inappropriate?
4. "If you learn one Macintosh application you have learned them all!" Comment on the accuracy or inaccuracy of the above statement.
5. What is meant by an "icon" in the Macintosh user-interface terminology? What is meant by a "folder"? What is meant by a "menu"?
6. Is it possible for a computer to store an analog signal? If yes then how and if not then why.
7. What is meant by the concurrency control problem? Give an example.

3 In class we emphasized the fact that a computer system consists of concentric *circles* of interpretation and control. The innermost of these circles is the bare hardware of a computer. At this level, the basic building blocks are circuit elements like transistors and gates, which can be used to build logic circuits to perform complex operations such as addition and multiplication. Briefly answer the following:

1. Why is binary the appropriate number system to be used with computer hardware?
2. You want to retrieve a text file that is 20 MegaBytes long from a remote computer onto your personal computer. You are using a modem that operates at a baud rate (speed) of 2400 bits per second. How long would it take to transfer that file? After retrieving this file, you would like to start printing it. How many pages of text would you expect this file to be? Assume each page has 40 lines of text, each with 60 characters. (20 Megabyte is quite a lot of text.. Isn't it?!)
3. How can you build an AND gate with 8 inputs using AND gates that have only 2 inputs?
4. What is a "truth table"? How many entries would you have in a truth table for a circuit that has 4 binary inputs and 2 binary outputs?
5. Show the truth table for the "minority" function of three bits `x`, `y`, and `z`. The output of the "minority" function should be "true" (or 1) if at most one of the inputs `x`, `y`, and `z` is "true". It should be "false" (or 0) otherwise.
6. How can you obtain a combinational circuit implementing some function given a truth table representation of that function?[a] Apply your procedure to obtain a combinational circuit (using AND, OR, and NOT gates) implementing the following truth table.

W	X	Y	Z
0	0	0	0
0	0	1	1
0	1	0	1
0	1	1	0
1	0	0	1
1	0	1	0
1	1	0	0
1	1	1	0

7. Label the circuit you obtained in the previous part with appropriate boolean values assuming that `w` = 0 and `x` = 1 and `y` = 0. Repeat for `w` = 0 and `x` = 1 and `y` = 1.
8. Add $(01101011)_2$ and $(00101110)_2$ using the binary number system. Now, transform both of these numbers as well as the result you obtained to decimal values and check that the result is what you expect.

[a] Recall the process we described and followed in class to obtain the circuit for a 1-bit adder.

4 Answer the following questions.

1. What is the difference between syntax error and semantic errors? Give an example of each.
2. When we access a piece of information from the WWW, we have to specify its URL. What are the main components of the following URL for the home page of our course: `http://cs-www.bu.edu/faculty/best/crs/cs101/Home.html`
3. What will be stored in the variables `a`, `b`, and `c` after we execute the following Pascal program segment.

```
a := 5 ;
b := 3 ;
c := a - b * 10 ;
b := b - a ;
```

4. Write a segment of a Pascal program that would exchange the contents of the two variables `x` and `y`.
5. What is the difference between compilers and interpreters?
6. What is the output of the following program segmentow many times will the message "Hello world" be printed in the following code segment.

```
for i := 1 to 10 do
  begin
    for j := 1 to 5 do
      writeln('Hello') ;
    writeln('Hello world!') ;
  end
```

7. The positive impact of computers in our lives is unquestionable (or?). For instance, one would hardly imagine the world we live in today without computerized telephone systems, computerized banking, computerized air-traffic controllers, computer animated graphics (cartoons), computer-aided architectural design, biomedical engineering, and computer controlled manufacturing, just to name a few. In considering such positives, one should not neglect potentially harmful negatives. One such negative is the effect of computers on privacy. Identify two problems related to privacy.
8. Explain the difference between point-to-point communication and network routing. When you send a message to a friend (say) in Japan, is your message sent using point-to-point communication or using network routing?
9. How many seconds of music can you store on a 1.44-Megabyte floppy disk? Assume that sound is sampled at a rate of 22 Kilohertz (22,000 samples per second) and that each sample is a value between 0 and 511.
10. The time complexity of a computer program is "linear" in the size of its input. Exlain. Give an example of such a program. If it takes 10 seconds to solve a problem of size 1000 using that program. How long would it take to solve a problem of size 2000?

Good Luck!