CSE120: Computer Science Principles 

Midterm Review: 2014

Note: You can bring 1 sheet of 8.5x11 paper with handwritten notes to the exam.

CSE120 has covered two kinds of information: Ideas and details concerning programming, such as for-loops, and ideas about computational topics, such as binary. The test covers all of the material so far, and therefore will cover both kinds of material.

Did You Get It?

Here are the main idea(s) from each of the 13 lectures we've had to midterm:

I. **Day 1** – we each have high expectations for one another; not on the test.
II. **Lightbot as programming** – though Lightbot 2.0 seemed like a game, it was also *programming*, defined to be the act of preparing instructions that an agent follows to achieve a specific goal.
III. **Functions In Lightbot** – *functional abstraction* is the act of identifying a sequence of operations that achieve a significant goal, and giving them a name; the identification creates a concept that can be used without reference to the operations that implement it.
IV. **Processing Intro** – Processing works pretty much like Lightbot, but without the drag-and-drop programming; we write down instructions, and the agent – the Processing Engine – follows them. What's new?
V. **Variables** – A *variable*, which must be declared, is a name for a value, and the value will have one of a small number of primitive datatypes: `int`, `float`, `color`, etc.
VI. **Functions & Datatypes** – We can extend the idea of functions (a) to return a value of a given datatype, and (b) to have parameters, which are input values to be used in the function's computation.
VII. **Testing and Repetition** – Programming languages come with two very handy statements, the *for*-statement, which allows for repeating instructions, and the *if*-statement, which allows a choice to be made as to which instructions to run.
VIII. **Mouse, Keys and Text** – Input (mouse, keys) and output (displayed text) are as important to computation as the processing; we look at their form in Processing.
IX. **Glories of 0-1** – Computing changes the world by means of a small list of inventions and inventive ideas, beginning with digitization and ending (?) with the WWW.
X. **Communicating In The Blink of an Eye** – A bit of information is the presence or absence of a phenomenon at a specific place and time.
XI. **Bits & Bytes** – The Bias-free Universal Medium Principle states that bits are sufficient to represent all discrete information, and that they do not have any inherent meaning.
XII. **Algorithms** – An algorithm is a precise, systematic process by for an agent to produce a specified result; algorithms use time, memory and other resources.
XIII. **Computers Operation** – A computer interprets instruction using the fetch/execute cycle, a mechanical and deterministic method of performing instructions in order.

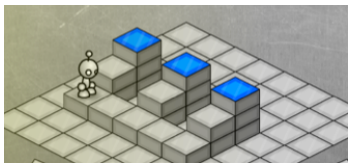
Questions Related To The Lectures & Labs

I. [This question won't be on the midterm, but please think about it.] This class claimed it would change how you think. Do you believe that has happened yet?

II. a) How does the Lightbot keep track of where it is in the program?
b) Lightbot (and computers) can do only a small repertoire of instructions; how do programmers avoid the tedium of using these primitive instructions all the time?
c) If F1 is a Lightbot function

Left, Jump, Jump, Left

Write an F2 so the solution for the problem at right is 3:F2.



III. a) Abstraction is recognizing a concept (for us) in a sequence of operations and giving it a name; why do we bother to abstract?
b) Give two ways in which the functions of Processing are better than the functions of Lightbot 2.0.
d) Name one component of the Android software stack that groups functions that are used to enter a phone number.
e) Solve the Lightbot problem in Slide 17.

IV. a) Explain how the two solutions (on Slides 6 and 7) are different by saying how they operate differently; mention both the image and the code.
b) If the Processing function `background(192, 64, 0)` were actually written in Processing, what is its first line of its definition likely to be?
c) Is the text `line(150, 150, mousex, mousey)` likely to be correct, likely to be incorrect, or unknown; explain your choice.
d) For the three bulleted `background( )` colors of slide 11, give the bit values for their three RGB bytes (refer to slide 6 of lecture 11).

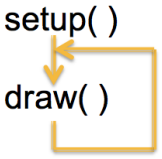
V. a) Write a function to draw a Ninja Turtle's goggles using this code for the body:

```
fill(gog_color);
rect(xpos, ypos, 40, 6);
```

b) The variable `gog_color` is probably used twice in your function in part (a); what term do we use to refer to each use of the word?
c) Define the term *variable*.
d) The numbers 3.14, 99.999999, 98.6, -40. and 0.0 are values with similar properties, so we say they are "members of a _____." Which one are they members of?
e) In your words, what is the purpose of the statement?

```
int ra = 200;
```

f) Give an example of a Boolean value.
g) Explain the diagram at right.



h) Referring to the program on slide 12, give the position of the goggles rectangle the *first time* Raff is drawn.
i) Explain what the `min( )` function does.
j) Suppose your friend has written a function whose first line is

```
void ninja(int xpos, int ypos, color goggles);
```

give a function call that makes the Ninja's goggles change colors randomly.

VI. a) In the lab you defined four columns by copy/pasting the code, and then adding some amount to the x-dimension to position it to the right of the columns that already exist. Give a better way to draw multiple columns.
b) Write a function that takes a Boolean value as an argument, and returns the opposite value.
c) Write a function that takes a color value as an argument, and returns true if the color is bright yellow; otherwise return false.
d) In the function

```
color gray (int shade, int number) {
   record = max(number, record);
   return color(shade+2, shade+2, shade+2);
}
```

give a list of the variable names that are *parameters*, and another list of the variable names that are *arguments*.
e) True or False? These two statements mean the same thing:

```
seconds = seconds + 1;
seconds + 1 = seconds;
```

VII. a) List all of the datatypes that we have used so far in Processing.
b) Given the for-loop

```
for (int i = 0; i < 4; i = i + 1) {
   rect(50, 50+20*i, 10, 10);
}
```

what is displayed?
c) In (b) what is displayed if the last use of 4 is changed to 5?
d) If `column( xpos, ypos)` is a function drawing a column at the position `xpos,ypos`, write a for-loop to draw ten columns in a row, every 100 pixels.
e) Given the if-statement

```
if (temp <= 32 && snowAmt > 0) {
  fill(255);
  ellipse(50,50,20,20);
}
```

what are two values that cause a white ellipse to be displayed?
f) In (e) what are two values that do not result in a white ellipse being displayed?
g) Suppose that in (e) the `&&` is replaced by `||`; then give two values that result in a white ellipse being displayed.
h) Assuming the change of (g), give two values that do not result in a white ellipse.
i) Suppose in US football, the `scrimmage_line` is in "midfield" whenever it is more than 45 and less than 55. Write an `if`-statement that returns 1 if it is in midfield, 0 otherwise; use the `return` statement.

VIII. a) Define `chars` for i, o and u.
b) What is the datatype of `key`?
c) What type of data is `"text"`?

IX. a) What is the value of digitizing information?

b) What was the first large-scale use of digital information?
c) Describe a mechanical process to determine how many men and how many women there are in a population. Is this an algorithm?
d) True or False: Computers are preferred machines to process information because it is easy to change both the instructions and the data.
e) Solid state electronics are preferred means of building computers for two reasons; what are they?
f) What printing technology led to the wild success of integrated circuits?
g) Cheap computers allowed their wide use, and their versatility allowed them to be applied to nearly everything. Name 5 uses you made of a computer today, which are not connected to this class.
h) The *Internet* is defined as the physical interconnection of named computers. If there are a billion computers connected by the Internet, and one more is added … how many new connections are made?
i) The WWW is a subset of computers on the Internet, called *Web servers*, together with all of the information and services that they provide. You can use the WWW if your computer "speaks" _____.

X. a) Define "a bit of information".
b) Give five examples of phenomena that can reveal information.
c) What are "present" and "absent" for the information "Ballard drawbridge ready for cars"?
d) Jean Dominique Bauby's answers to yes/no questions encoded two bits of information. What were they? What were the present/absent indications?
e) The French word for cat is "chat" … is this a word that benefits from "frequency order" search?
f) Define *byte*.
g) What do the bits at the bottom of the ASCII Slide say?
h) The Web pages you read say in the first or second line of the HTML: "UTF-8" … what is that?
i) Define *meta-data*.
j) Explain how meta-data helps find words in the digital version of the *OED*.
k) True or False? A bit of information can be considered *memory* if it can be detected without changing it and be set to be either present or absent.
l) The binary sequence `10 0101` represents what decimal number?
m) Compute the binary sum:

```
   11 0101
+  10 1100
```

n) Write out all of the four-bit binary sequences. How many are there?

XI. a) A "picture element" is more commonly known as what?
b) What is the bit setting for a pure blue color of 7/8's intensity?
c) When digitizing a "continuous medium" like sound, what are the two key quantities that determine the accuracy of the digital approximation?
d) Approximately how many bytes does it take to represent uncompressed digitally encoded sound?
e) Define "lossless" and "lossy" compression.
f) MP3 uses which kind of compression.

g) JPG uses which kind of compression.
h) “Run-length” encoding illustrates what?
i) True/False? Bits are used to directly encode binary numbers and other quantities, which is different than how ASCII encodes letters.
j) What do these bits represent?
`0000 0000 1111 0001 0000 1000 0010 0000`?
k) State the fundamental principle of bits.

XII. a) Define *algorithm*.
b) Using exchange sort, work out the steps to sort: partridge, birds, doves, gold, maids
c) Using bubble sort, sort the items given in (b).
d) How many steps did the (b) and (c) sorts take?
e) Write down single words for each of the 12 Days of Christmas, and sort them using Merge sort.
f) Say in English why the sorting algorithms of (b), (c) and (e) work.

XIII. a) Name the principal parts of a computer.
b) Say in one sentence what the [instruction fetch, instruction decode, data fetch, execute, result return] step of the Fetch / Execute Cycle Does
c) The fetch/execute cycle is the process by which instructions are executed, that is, they are the “agent following the instructions”. What other “agents” have we seen in this class?