Exam 1 Review Worksheet
CS/ECE 252 Section-2 (MWF 11:00)

Distributed on Wednesday, September 23rd
Discussed on Friday, September 25th
Exam on Monday, September 28th

1. Logic gates is a level of abstraction between microarchitecture and transistors. How exactly does logic gates connect microarchitecture to transistors?

The computer's microarchitecture is a high-level organization of circuits organized according to their various jobs. These units are expressed in terms of basic components called logic gates. Logic gates are made up of transistors, which are actual physical devices one can build.

2. Recall the layers of abstraction involved in computing, from the very highest **system** level all the way down to the **transistor** level. What layer of abstraction is described in each of the following statements? **(2)**

2.1 A bunch of loads into memory, stores from memory, arithmetic computational instructions, and a branching instruction at the ISA level, is all contained in one single Python "if" statement.
2.2 This contains both the architecture of a computer as well as the instruction set for each different component.
2.3 An ALU consists of many AND and OR gates.
2.4 A very common type of 2-input NAND gate consists of 4 transistors.

1. programming language 2. ISA 3. microarchitecture 4. logic gates

3. What role does the number sign, pound sign, or hashtag character (#) play in Python? Give an example of using it.

# is the comment sign.
# this is a comment
# this will be ignored by the compiler

4. Step through this code by filling out the table below.

```
(i)   x = 13
(ii)  while(x > 5):
(iii)      print("hello")
(iv)       x = x - 3
```

Current line	**Calculation performed by this line**	**Variables**	**Next line:**
		x	
i	initializing x to 13	13	ii
ii	checking if x > 5	13	iii
iii	printing hello	13	iv
iv	subtracting 3 from 13 and storing it back in x	10	ii
ii	checking if x > 5	10	iii
iii	printing hello	10	iv
iv	subtracting 3 from 10 and storing it back in x	7	ii
ii	checking if x > 5	7	iii
iii	printing hello	7	iv
iv	subtracting 3 from 7 and storing it back in x	4	ii
ii	checking if x >5	4	END

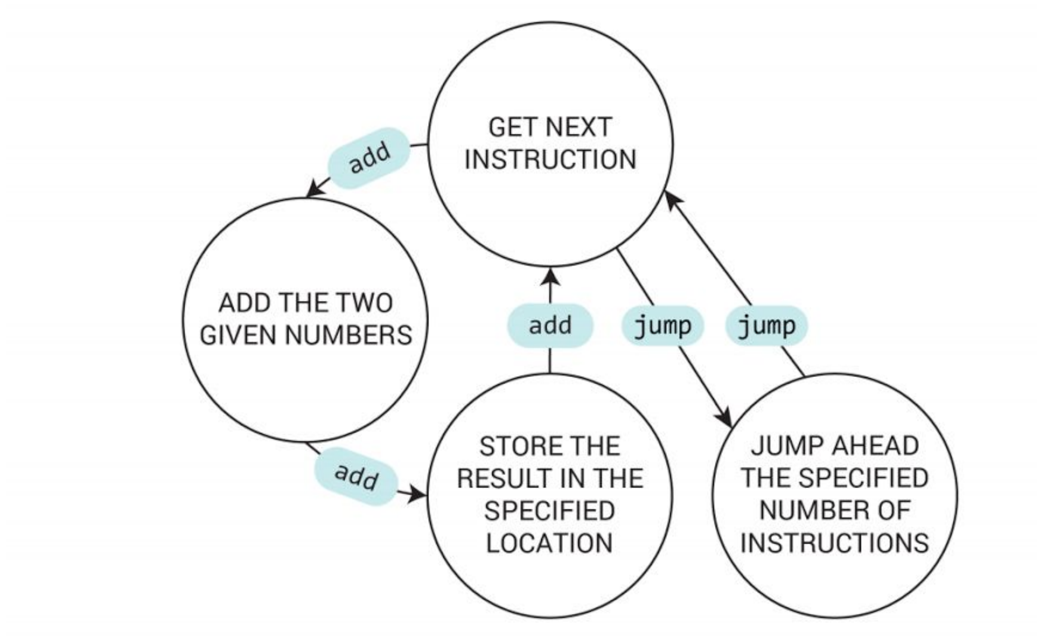
5. Give a counterexample to this statement: *Using only letters, numbers, and underscores will always form a valid variable name.*

Anything that starts with a number is an invalid variable name.

6. You are given three variables *a*, *b*, and *c*. Write a program to sort them ascending, such that *a* will be less than or equal than *b,* which will be less than or equal to *c*. Feel free to use Homework 2 Question 10 (write a program to swap values of two variables) to assist you. You may create additional variables if needed.

```
a = 2
b = 1
c = 3

if (a >= b):
      #swap
      temp = a
      a = b
      b = temp

if (b >= c):
      #swap
      temp = b
      b = c
      c = temp

if (a >= b):
      #swap
      temp = a
      a = b
      b = temp

print a, b, c
```

7. Let say this is our state machine.


GET NEXT INSTRUCTION
add
ADD THE TWO GIVEN NUMBERS
add
jump
jump
add
STORE THE RESULT IN THE SPECIFIED LOCATION
JUMP AHEAD THE SPECIFIED NUMBER OF INSTRUCTIONS

Also, let's say that our machine is currently in the "GET NEXT INSTRUCTION" state. What state will our state machine be in after add, add, add, jump, jump, add, add?

Action	*start*	*add*	*add*	*add*	*jump*	*jump*	*add*	*add*
State	GET NEXT INSTRUC TION	ADD THE TWO GIVEN NUMBER S	STORE THE RESULT	GET NEXT INSTRUC TION	JUMP AHEAD THE SPECIFIC NUMBER	GET NEXT INSTRUC TION	ADD THE TWO GIVEN NUMBER S	STORE THE RESULT

8. Let's say a piece of code does not work as expected. How do you determine whether it is a syntax error or a logic error?

If it doesn't run or compile, it's a syntax error. If it runs but the result is not what was expected, it's a logic error.

9. (a) What is abstraction? Why is it important?

Abstraction is the consideration of a system as a series of subsystems that interact with each other. We do not need to know the details of the implementation, only how the interface of how to use them. This allows us to consider each subsystem separately and makes it easier to debug them.

(b) Give a brief description of the following layers of abstraction:

i. programming language

A programming language is a more human-friendly way of specifying to the computer what computations to perform.

ii. microarchitecture

This is the high-level organization of computer circuit according to the job they perform.

iii. ISA

The Instruction Set Architecture is the low-level set of instructions that the computer directly understands.

10. What is an algorithm? What are trade-offs when it comes to writing an algorithm?

An algorithm is a series of steps for solving a problem. They must be unambiguous, and it must terminate. Trade-offs occur when we must sacrifice one aspect of an algorithm's needed resource for another: for example, speed for memory utilization.

11. What is a computer? What is the difference between a stored-program device and a fixed-program device?

A computer is a machine capable of four things: I/O, storage, arithmetic, and branching. A fixed-program device is capable of executing only one algorithm. A stored-program device is capable of running different programs or instructions.

12. Write a program to compute the factorial of 4. Your final printed answer should be 24. You may create as many variables as needed.

(many variations)

```
input = 4
answer = 1
counter = 1
while(counter <= input):
  answer = answer * counter
  counter = counter + 1
  print answer
print(answer)
```

13. Rewrite the following piece of code using an array

```
temp1 = 72.7
temp2 = 74.6
temp3 = 68.9
temp4 = 70.2
temp5 = 76.1
print("local temperatures:")
print("Station 1: " + temp1)
print("Station 2: " + temp2)
print("Station 3: " + temp3)
print("Station 4: " + temp4)
print("Station 5: " + temp5)
```

```
//using the super basic array stuff taught in the chapter
temps = [72.7, 74.6, 68.9, 70.2, 76.1]
counter = 5
i = 0
while(i<counter):
     print "Station ", i +1, ": ", temps[i]
     i = i+1
```

14. Write a function that accepts two numbers and return the product of the two numbers.

```
def multiply(a, b):
        return a*b
```

15. Create a 5 x 5 multiplication table. Use the function you created in question 14 to do the multiplication. Store the products in a two dimensional array (an array of an array), and print the two dimensional array at the end.

```
def mult(a, b):
        return a*b

nums = [[0, 0, 0, 0, 0],[0, 0, 0, 0, 0],[0, 0, 0, 0, 0],[0, 0, 0, 0, 0],[0, 0, 0, 0, 0]]

i = 1
while (i <= 5):
        j = 1
        while (j <= 5):
                nums[i-1][j-1] = mult(i,j)
                j = j+1
        i = i+1
print nums
```

17. Print the outputs of the following piece of code.

```
def foo(x):
   print(x)
   x = 5
   return x
y = 3
print(foo(y))
print(y)
```

```
3
5
3
```