Computer Science 217

Midterm Exam

Spring 2009

June 15, 2009

Name: _____

ID: _____

Instructions:

- Neatly print your name and ID number in the spaces provided above.
- Pick the best answer for each multiple choice question.
- Answer each question by writing the correct answer in the space provided. **Answer all multiple choice questions using UPPER CASE letters.**
- This exam consists of 11 pages, including the cover. Before answering any questions count the pages and ensure that they are all present.
- You have 1 hour 50 minutes to complete this exam. However, it is likely that you will be able complete the exam in less time.
- Unless noted otherwise, each question is worth one mark.
- This exam is closed book. You are not permitted to use any electronic devices or reference materials.
- **DO NOT TURN PAST THIS PAGE UNTIL YOU ARE INSTRUCTED TO BEGIN**

1. What is Computer Science?

2. Which of the following devices was the first one used to assist with mathematical calculations?
    A. Abacus
    B. Babbage Difference Engine
    C. ENIAC
    D. Relay
    E. Vacuum Tube

    Answer: _____

3. The branch of computer science that explores the differences between problems that can be solved with a computer and problems that cannot be solved with a computer, no matter how fast, is:
    A. Human-Computer Interaction
    B. Theory of Computation
    C. Artificial Intelligence
    D. Software Engineering
    E. Databases

    Answer: _____

4. **[3 marks]** Consider the top down design problem solving approach. Using this system, what steps would you take to solve a new problem that you had not previously been exposed to?

5. Within Bloom's taxonomy, which of the following levels of competence represents the greatest level of understanding of a problem?
   A. Analysis
   B. Application
   C. Comprehension
   D. Knowledge
   E. Synthesis

   Answer: _____

6. Programming is:
   A. The process of converting an algorithm into an electronic circuit
   B. The process of converting a Python program into a form that can be directly executed by the central processing unit in the computer
   C. The process of creating an algorithm
   D. The process of identifying hidden relationships within a complex system
   E. None of the above answers are correct

   Answer: _____

7. In one sentence, what is an algorithm?

8. Consider the following code segment:

```
a = raw_input()
b = raw_input()
c = a + b
print c
```

When the program is run, the user first enters 10 and then 5. The output generated by the program will be:
   A. 5
   B. 10
   C. 15
   D. 105
   E. 510

   Answer: _____

9. Consider the code segment from the previous question. If the user first enters "Hello" (without the quotes) and then enters "World!" (without the quotes) then the output will be:
   A. 0
   B. Hello World!
   C. HelloWorld!
   D. Nothing is displayed by the program
   E. None of the above answers are correct

   Answer: _____

10. Which of the following statements is most correct?
    A. Reading the value of a Python variable may change the value of that variable
    B. Assignment statements are used to display output from a Python program
    C. Using magic numbers increases the readability of a program
    D. Comments in a Python program are ignored by the computer
    E. None of the above answers are correct

    Answer: _____

11. Consider the following expression that could appear in a Python program.

    ```
    a = 3 * 2 ** 3 – 2
    ```

    After it is evaluated, the value of a will be: _____

12. Which of the following types of error is identified by an error message that is displayed while your Python program is running (possibly after it has already generated some correct output)?
    A. Design Error
    B. Logic Error
    C. Runtime Error
    D. Semantic Error
    E. Syntax Error

    Answer: _____

13. A program which reads the source code for another program and executes it generating a result is known as a:
    A. Assembler
    B. Bridge
    C. Bus
    D. Compiler
    E. Virtual Machine

    Answer: _____

14. Which of the following is an example of a format specifier:
    A. %.2f
    B. DESIRED_GRADE = "A+"
    C. v = 4 % a
    D. y = m * x + b
    E. More than one of the above answers is correct

    Answer: _____

15. The process that changes information into data is known as:
    A. Casting
    B. Consulting
    C. Converting
    D. Encoding
    E. Informing

    Answer: _____

16. Convert 221 base 7 to base 10.

Answer: _____

17. Convert 75 base 10 to binary.

Answer: _____

18. Convert 21010 base 4 to base 9.

Answer: _____

19. What is the primary motivation for using UTF-8 instead of ASCII?

20. Which type of data is the simplest to represent in a computer?
    A. Algebraic
    B. Boolean
    C. Floating Point
    D. Integer
    E. Visual

Answer: _____

21. What level of white-box test coverage provides the greatest level of assurance that your program is free of bugs?
    A. Condition coverage
    B. Graph coverage
    C. Heuristic coverage
    D. Path coverage
    E. Statement coverage

Answer: _____

22. Consider the following Python code segment:

```
if a < b:
  print "a is less than b!"

if c < d:
  print "That's good..."
elif d > c:
  print "Even better!"

print "All done!"
```

How many test cases are required to achieve statement level test coverage for this code segment? _____

Consider the following code segment for questions 23 through 25:

```python
x = input("Enter x: ")
y = input("Enter y: ")

if x == 1:
  y = y + 1
  print x
  if y > 3:
    x = x + 1
    print y
elif x == 2:
  print x
  x = x + 1

if y < 3:
  print x
else:
  print y
```

23. If the user enters 1 and 3 when prompted, the output from this program will be: _____

24. If the user enters 3 and 1 when prompted, the output from this program will be: _____

25. If the user enters 2 and 2 when prompted, the output from this program will be: _____

26. **[2 marks]** Complete the following truth table for the expression (a AND b) OR (NOT c).
Clearly label the column that represents the truth values for the entire expression.

a	b	c	
0	0	0	
0	0	1	
0	1	0	
0	1	1	
1	0	0	
1	0	1	
1	1	0	
1	1	1	

27. Which of the following statements is most correct?
    A. Any Python while loop can be re-written as a Python repeat-until loop
    B. Pre-tested loops always execute one or more times
    C. Python while loops are an example of a pre-tested loop
    D. The body of a Python while loop is always a compound statement
    E. None of the above answers are correct

Answer: _____

28. Consider the following code segment:

```
result = 0
for i in range(10,2,-2):
  result = result + i

print result
```

When this code runs, the first value that it will print is:
     A. 2
     B. 10
     C. 18
     D. 28
     E. 30

Answer: _____

29. Briefly describe a situation where you would have to use a Python while loop because the same program could not be written using a for loop.

Consider the following code segment for questions 30, 31 and 32.

```
i = input("Enter i: ")
x = 1

while i < 7:
  if i < 4:
    x = x + 1
  i = i + x
  x = x * 2

print i
print x
```

30. If the user enters 6 for i then the output from this code segment will be: _____

31. If the user enters 3 for i then the output from this code segment will be: _____

32. If the user enters 0 for i then the output from this code segment will be: _____

33. In computer science, what is a function?

34. **[2 marks]** It is commonly said that using functions eases program debugging and maintenance. Describe how functions provide this benefit. (Note that this question is only worth 2 marks. While your answer should include 2 distinct points, the rest of the page is open to make the spacing work for the next question, not because you need to fill all of the space with your answer to this question).

35. **[9 marks]** A triangle can be classified by the lengths of its sides. Given three lengths, it is possible that the triangle could be equilateral (all sides have equal length), isosceles (exactly two sides have equal length) or scalene (all three sides have different lengths). In addition, it is possible that three lengths do not form a valid triangle. For example, lengths 1, 2 and 3 cannot be used to form a triangle with sides of the indicated lengths because there is one side that is at least as long as the sum of the other two sides.

Create a Python program for classifying triangles. Your program should prompt the user for three lengths and either indicate that the lengths do not form a valid triangle, or if the triangle is valid, the type of triangle (equilateral, isosceles or scalene).

Hint: Start by determining if the side lengths entered form a valid or triangle or not. Then, if you have a valid triangle, do addition checks to see what kind of triangle it is.

36. **[9 marks]** The trigonometric function, sin(x), can be approximated by the following series:

$$\sin(x) \doteq x - \frac{x^3}{3!} + \frac{x^5}{5!} - \frac{x^7}{7!} + \frac{x^9}{9!} - \cdots$$

Assume that there is a factorial function in Python's math library which takes a single parameter, n, and computes and returns n-factorial as a floating point number.

Using this factorial function, write a program that reads a value of x from the user and a count of the number of terms to use. Your program should compute an approximation of sin(x) as the sum of the first count terms of the series above. Include prompts for the user and an appropriate message when displaying the result.