Computer Science 217

Midterm Exam

November 1, 2017

First Name: _____

Last Name: _____

ID: _____

Class Time (Circle One):   10:00am   3:00pm

Instructions:

- Neatly print your names and ID number in the spaces provided above. Neatly print your names and ID on the provided answer sheet, and shade the circles for your student ID number.
- Circle your class time (the section in which you are most likely to pick up your exam, even if you are actually enrolled in the other section), and shade the circle for your class time on the answer sheet.
- Answer questions 1 to 6 in this exam booklet. Record your answers for questions 7 to 38 on the provided answer sheet.
- Pick the **best answer** for each multiple choice question.
- This exam consists of 14 pages, including the cover. Before answering any questions count the pages and ensure that they are all present.
- You have 1 hour 30 minutes to complete this exam. Extra time will **not** be provided to record your answers on the answer sheet. Ensure that all of your answers have been recorded before the time limit is reached.
- 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**

This exam will be returned in class on Friday November 3rd with additional questions. You may earn up to one third of a letter grade (for example, a C would become a C+, a B+ would become an A-, etc.) in additional credit on the midterm exam by completing these additional questions and submitting your answers by Wednesday November 15th.

1. **[12 marks]** Consider a sequence of integers formed in the following manner:

Start with any positive integer as the only term in the sequence
While the last term in the sequence is not equal to 1
    If the last term is even then add another term to the sequence by
        dividing the last term by 2 using integer division
    If the last term is odd then add another term to the sequence by
        multiplying the last term by 3 and adding 1

The Collatz conjecture states that this sequence will eventually end with a 1 when it begins with any positive integer n, though this conjecture has never been proved.

Create a program that reads an integer n from the user and determines how many values there will be in the sequence starting with n until it reaches 1. Your program should allow the user to continue entering values (and your program should continue displaying the number of steps) until the user enters a number less than or equal to zero. Your prompts and output messages should match the output shown below. Values that were typed by the user are bolded.

Sample Run #1:
```
Enter an integer (0 or less to quit): 1
The length of the sequence was 1
Enter an integer (0 or less to quit): 2
The length of the sequence was 2
Enter an integer (0 or less to quit): 4
The length of the sequence was 3
Enter an integer (0 or less to quit): 8
The length of the sequence was 4
Enter an integer (0 or less to quit): 0
```

Sample Run #2:
```
Enter an integer (0 or less to quit): 3
The length of the sequence was 8
Enter an integer (0 or less to quit): 5
The length of the sequence was 6
Enter an integer (0 or less to quit): 6
The length of the sequence was 9
Enter an integer (0 or less to quit): 7
The length of the sequence was 17
Enter an integer (0 or less to quit): 27
The length of the sequence was 112
Enter an integer (0 or less to quit): 0
```

Sample Run #3:
```
Enter an integer (0 or less to quit): -1
```

Answer the questions on this page in this exam booklet.

Place your answer to question 1 on this page. You do **<u>not</u>** need to include comments in your code.

out of 12

2. **[2 marks]** Consider the following items. Some of the items are legal (allowed) names for a variable in a Python program, while others are illegal (<u>not</u> allowed). Circle all of the items that are **legal (allowed)** for variable names. Note that you should only consider whether or not the name is legal. A name may still be legal even if it is stylistically poor.

BB8	python	#CPSC
Two-words	_1_2_3	cookies!
A(n)	mIxEdCaSe	sqrt

3. Consider the following program:

```
n = float(input("Enter a number: "))

print("That's %.2f when rounded to 2 decimal places", n)
```

This program is supposed to display the value entered by the user rounded to two decimal places, but it currently contains a bug causing incorrect output. For example, if the user enters 1 the program should display "That's 1.00 when rounded to 2 decimal places" but its actual output is "That's %.2f when rounded to 2 decimal places 1.0". If the user enters 1.246 it should display "That's 1.25 when rounded to 2 decimal places" but its actual output is "That's %.2f when rounded to 2 decimal places 1.246".

What change should be made to this program so that it will run correctly? Write the modification that is needed into the program above, crossing out any code that should be removed and clearly indicating where any new code should be inserted. Change only one line in the program.

4. Consider the following program:

```
n = input("Enter a number: ")

print("Triple", n, "is", 3 * n)
```

This program is supposed to display triple the value entered by the user. For example, if the user enters 2 then the program should display 8. However, instead of displaying 8, the program actually displays 222. Similarly, if the user enters 44 the program should display 132, but it actually displays 444444.

What change should be made to this program so that it will run correctly? Write the modification that is needed into the program above, crossing out any code that should be removed and clearly indicating where any new code should be inserted. Change only one line in the program.

out of 4

5. Consider the following code segment:

```
bmi = float(input("Enter your bmi: "))

if bmi < 18.5:
  print("You are underweight.")
if bmi < 25:
  print("You are normal weight.")
else:
  print("You are overweight.")
```

This program is supposed to report whether the user is underweight, normal weight or overweight based on the entered BMI value. If the BMI is less than 18.5 then the program should report underweight. If the BMI is greater than or equal to 18.5 and less than 25 then the program should report normal weight. Otherwise the program should report overweight.

Right now the program functions correctly for normal weight and overweight BMI values, but behaves incorrectly for underweight BMI values. For example, if the user enters a BMI of 17 the program prints two messages, one (correctly) stating that the user is underweight and a second that (incorrectly) states that the user is normal weight.

What change should be made to this program so that it will run correctly? Write the modification that is needed into the program above, crossing out any code that should be removed and clearly indicating where any new code should be inserted. Change only one line in the program.

6. Consider the following program:

```
a = int(input("Enter a value: "))
count = 0

while a != 0:
  a = int(input("Enter a value: "))

print("You entered", count, "values.")
```

It is supposed to count the number of values entered by the user until the user enters 0 and then display the count (not including the 0). However, when the program is run, it always displays 0, no matter how many input values are entered.

What change should be made to this program so that it will run correctly? Write the modification that is needed into the program above, crossing out any code that should be removed and clearly indicating where any new code should be inserted. Change only one line in the program.

out of 2

7. Which of the following is the **best** definition of a modern computer?
   A. A boxy device with a typewriter-like interface that processes information
   B. A mechanical device capable of outputting information
   C. A mechanism for performing logic and control
   D. A tool that receives, processes and presents data
   E. An electronic device that accepts information in digital form

8. Which type of electronic switch is used to construct modern computers?
   A. Diode
   B. Relay
   C. Thermocouple
   D. Transistor
   E. Vacuum Tube

9. Which of the following components has a direct connection to the CPU in a modern computer architecture?
   A. Hard disk drive
   B. Main memory
   C. Scanner
   D. Exactly two of the above answers are correct
   E. Answers A, B and C are all correct

10. The area of computer science that studies techniques for coordinating the behavior of many computers, and problems such as race conditions and deadlock is known as:
    A. Distributed Systems
    B. Human Computer Interaction
    C. Information Visualization
    D. Software Engineering
    E. Theory of Computation

11. Within Bloom's Taxonomy, the level of competence that is characterized by the ability to compare two or more distinct solutions and identify their strengths and weaknesses is:
    A. Analysis
    B. Application
    C. Comprehension
    D. Evaluation
    E. Knowledge

out of 5

12. Consider the following definition:

    A(n) _____ sequence of _____ steps to solve a problem.

    Which words should be inserted into the blanks to provide the best definition of an algorithm?
    A. Finite, Effective
    B. Finite, Mathematical
    C. Finite, Theoretical
    D. Infinite, Theoretical
    E. Infinite, Unambiguous

13. An unnamed or poorly documented numeric value is known as a(n):
    A. Arbitrary Number
    B. Constant Number
    C. Hexadecimal Number
    D. Magic Number
    E. Named Number

14. The process of converting a program from human-readable source code into machine language instructions is accomplished using a(n):
    A. Bridge
    B. Compiler
    C. Interpreter
    D. Translator
    E. Virtual Machine

15. What does the ** operator denote in Python?
    A. Exponentiation
    B. Integer division
    C. Integration
    D. Multiplication
    E. Remainder

16. Encoding is the process of:
    A. Converting data into information
    B. Converting information into data
    C. Converting input into output
    D. Converting output into input
    E. Converting numbers from one base to another base

out of 5

17. Convert 221 base 7 to base 10.

18. Convert 203 base 10 to hexadecimal (base 16).

19. Convert 431 base 5 to base 8.

out of 3

20. In a particular video game, a player is limited to having 127 lives. Based on this information, the number of bits being used to store the number of lives is most likely:
    A. 2
    B. 7
    C. 12
    D. 27
    E. 127

21. The character encoding system that allows 128 distinct characters to be represented is known as:
    A. ASCII
    B. CHAR
    C. STRING
    D. TEXT
    E. UTF-8

22. Which of the following operators has the lowest precedence?
    A. not
    B. **
    C. +
    D. >
    E. =

23. Consider a program that converts from degrees Fahrenheit to degrees Celsius. When the user enters 0 degrees Fahrenheit, the program reports 32 degrees Celsius, but the correct answer is actually -17.8 degrees Celsius. Based on this information, the error would best be classified as a:
    A. Logic error
    B. Numeric error
    C. Runtime error
    D. Syntax error
    E. Value error

    Answer: _____

24. 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

out of 5

25. Consider the logical expression (X and not Y) or (not X and Y). Which column in the following truth table is the result computed by this expression?

X	Y	A	B	C	D	E
0	0	1	1	0	0	0
0	1	0	1	1	1	0
1	0	0	0	1	0	1
1	1	1	0	0	1	1

26. Which of the following statements is most correct?
    A. In Python, both while loops and for loops are pre-tested loops.
    B. In Python, while loops are pre-tested loops. For loops are post-tested loops.
    C. In Python, while loops are post-tested loops. For loops are pre-tested loops.
    D. In Python, both while loops and for loops are post-tested loops.
    E. None of the above statements is correct.

Consider the following code segment:

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

if x >= 1:
   x = x + 1
   y = y - 1
   z = 0
if x == 2:
   x = x + 1
   y = y * 2
   z = 1
if y < 4:
   x = x + 1
   y = y + 1
   z = -1

print(x, y, z)
```

27. What values will be output if the user enters 1 for x and 4 for y?

28. What values will be output if the user enters 2 for x and 1 for y?

out of 4

Consider the following code segment:

```
a = int(input())
b = int(input())

if a > 0:
   b = b + 1
   if b > 0:
      a = a - 1
   else:
      a = a + 1
elif b > 0:
   a = a + 1
   if a > 0:
      b = b - 1
   else:
      b = b + 1

print(a, b)
```

29. What values will be output if the user enters 0 for a and 2 for b?

30. What values will be output if the user enters 1 for a and 1 for b?

Consider the following code segment:

```
a = int(input())
b = 0
c = 2

while b < a:
   print(c)
   if b % 2 == 0:
      for i in range(0, b):
         c = c * 2
   else:
      c = c - 1
   b = b + 1

print(c)
```

31. What output is generated if the user enters 2 for a?

32. What output is generated if the user enters 4 for a?

out of 4

33. Consider the following code segment:

```
total = 0
i = 7
j = int(input("Enter j: "))

while (j < i):
  print("B")
  for k in range(j, i):
    print(k)
    total = total + k
  total = total + j
  j = j + 1

print(total)
```

Which of the following values for j will result in no output being generated?

    A. -1

    B. 1

    C. 5

    D. 9

    E. None of the above answers are correct (all will result in output being generated)

out of 1

34. Consider the following loop:

```
j = 10
while j >= 5:
  print("X")
  j = j - 1
```

Which of the following for loops will generate the same output as the loop shown previously?

A. ```
   for j in range(-1, -5, -1):
       print("X")
   ```

B. ```
   for j in range(0, 5):
       print("X")
   ```

C. ```
   for j in range(10, -1, -2):
       print("X")
   ```

D. ```
   for j in range(10, 5):
       print("X")
   ```

E. ```
   for j in range(10, 5, -1):
       print("X")
   ```

35. What is the minimum number of times that a post-tested loop will execute?
    A. 0
    B. 1
    C. 2
    D. 10
    E. None of the above answers is correct.

36. Consider the following code segment:

```
i = 0
while i < 10:
  for j in range(1, 10):
    print("A")
  print("A")
  i = i + 1
```

How many copies of the letter A are displayed when it runs?

out of 3

Answer the questions on this page on the provided answer sheet.
Answers recorded in this exam booklet will <u>NOT</u> be graded.

Consider the following code segment:

```
a = int(input("Enter an integer: "))

for i in range(1, a):
  t = 0
  for j in range(1, i):
    t = t + j
  t = t * i
  print(t)
```

37. What output is generated if the user enters 3 for a?

38. What output is generated if the user enters 4 for a?

out of 2