Computer Science 217

Midterm Exam

March 3, 2017

First Name: _____

Last Name: _____

ID: _____

Class Time (Circle One):   12:00pm   2:00pm

Instructions:

- Neatly print your names 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 12 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.
- 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 test will be returned in class on Monday March 6th 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 March 15th.

out of 50

1. [12 marks] A proper divisor of a positive integer, n, is a positive integer, d, which divides evenly into n and is not equal to n. For example, the proper divisors of 24 are 1, 2, 3, 4, 6, 8 and 12 while the proper divisors of 9 are 1 and 3.

A number is said to be abundant if the sum of its proper divisors is greater than the number itself. For example, 24 is an abundant number because 1 + 2 + 3 + 4 + 6 + 8 + 12 = 36, which is greater than 24. A number is said to be deficient if the sum of its proper divisors is less than the number itself. For example, 9 is a deficient number because 1 + 3 = 4, which is less than 9. A perfect number is a positive integer where the sum of its proper divisors is equal to the number. For example, 6 is a perfect number because its proper divisors are 1, 2 and 3, and they sum to 6. Note that 1 is a deficient number because it has no proper divisors.

Write a program that reads integers from the user until the user enters a value less than or equal to 0. For each entered integer (other than the value that is less than or equal to 0) your program should report whether the number is abundant, perfect, or deficient.

Sample input and output is shown below. Values entered by the user are shown in bold.

Enter an integer (0 or less to quit): **6**
That's a perfect number
Enter an integer (0 or less to quit): **24**
That's an abundant number
Enter an integer (0 or less to quit): **9**
That's a deficient number
Enter an integer (0 or less to quit): **0**

A second set of sample input and output is shown below:

Enter an integer (0 or less to quit): **8**
That's a deficient number
Enter an integer (0 or less to quit): **-6**

Ensure that your program behaves in a reasonable manner if the first number entered is less than or equal to 0. The prompts and messages in your program should match the sample input and output.

Hint: Recall that the % operator computes the remainder when one integer is divided by another. An integer, d, is a divisor of another integer n when n % d is equal to 0.

Place your answer to this question on the next page. Do **not** write your answer on the bottom of this page.

0

Place your answer to question 1 on this page.

out of 12

2. Which of the following devices was constructed using vacuum tubes?
    A. Abacus
    B. Difference Engine
    C. ENIAC
    D. Moore's Machine
    E. Wii

    Answer: _____

3. Which of the following devices is **not** normally connected to the platform controller hub in a modern computer?
    A. Audio subsystem
    B. Hard disk
    C. Keyboard
    D. Main memory
    E. Printer

    Answer: _____

4. The area of computer science that is concerned with modelling problems so that many people can work on them simultaneously is:
    A. Artificial Intelligence
    B. Distributed Systems
    C. Human Computer Interaction
    D. Software Engineering
    E. Theory of Computation

    Answer: _____

5. The statement "Computer science is no more about computers than astronomy is about telescopes" was originally said by:
    A. Benjamin Bloom
    B. Charles Babbage
    C. Edsger Dijkstra
    D. Gordon Moore
    E. Tony Gaddis

    Answer: _____

6. The level of competence that is characterized by the ability to separate a complex system into components is:
    A. Analysis
    B. Application
    C. Comprehension
    D. Evaluation
    E. Knowledge

    Answer: _____

out of 5

7. 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

    Answer: _____

8. Python is an example of a:
    A. Domain-specific language
    B. Human language
    C. High level language
    D. Low level language
    E. Machine language

    Answer: _____

9. Which of the following statements is **not** correct?
    A. Variable names may contain digits (0-9)
    B. Variable names must begin with a letter or an underscore
    C. Variable names must contain at least one letter (A-Z or a-z)
    D. Variable names must not be a reserved word
    E. Variable names should be meaningful

    Answer: _____

10. It is recommended that a name that is in all capital letters be used to denote:
    A. A function that does not return a value
    B. A function that returns multiple values
    C. A variable that changes each time a loop body runs
    D. A variable that is only assigned a value once and is treated as a constant
    E. A variable that stores input received from the user

    Answer: _____

11. An error in a program that causes it to produce incorrect output, but does not display an error message is known as a:
    A. Compiler Error
    B. Logic Error
    C. Runtime Error
    D. Syntax Error
    E. Value Error

    Answer: _____

out of 5

12. Consider the following program:

```
a = int(input("Enter an integer: ")
print("Twice", a, "is", a * 2)
```

This program is supposed to display the value entered by the user and twice its value. For example, if the user enters 3 then the program should output Twice 3 is 6. If the user enters 10 then the program should output Twice 10 is 20. Right now the program crashes with the following error message:

```
File "error_2.py", line 3
    print("Twice", a, "is", a * 2)
        ^
SyntaxError: invalid syntax
```

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.

13. Consider the following program.

```
n = int(input("Enter a positive integer: "))
total = n*n + n / 2
print("The total of the first n positive integers is", total)
```

It is supposed to calculate the total of the first n positive integers, which can be computed with the formula $total = \frac{n^2+n}{2}$. However, the program does not produce correct results. For example, when the user enters 4, the program reports 18.0 when the total should actually be 10.0. When the user enters 6, the program reports 39.0 when the total should actually be 21.0. No error messages are displayed when the program runs.

What change should be made to this program so that it will display the correct total? 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.

14. Which of the following statements displays the value of x so that there are always exactly 5 digits to the right of the decimal point?
    A. print("%.5f" % x)
    B. print("x.5f")
    C. print(%5f, x)
    D. print(x % ".5f")
    E. print(x, 5f)

    Answer: _____

15. The process of taking information and changing into data values that can be used within a computer is known as:
    A. Compiling
    B. Decoupling
    C. Encoding
    D. Interpreting
    E. Transmuting

    Answer: _____

16. A single digit that can either be 0 or 1 is referred to as a:
    A. Bit
    B. Byte
    C. Character
    D. Variable
    E. Word

    Answer: _____

17. Convert 316 base 7 to base 10. Please remember to write your final answer in the provided space.

    Answer: _____

out of 4

18. Convert 110 base 10 to base 14. Please remember to write your final answer in the provided space.

Answer: _____

19. Convert 1131 base 4 to base 16. Please remember to write your final answer in the provided space.

Answer: _____

20. Which of the following characters is not available in the 7-bit ASCII character encoding scheme?
    A. A   (capital letter A)
    B. b   (lower case letter B)
    C. 3   (the digit 3)
    D.)   (closing round bracket)
    E. é   (lower case E with an accent)

Answer: _____

21. Which of the following statements is most correct?
    A. The condition for an if statement must evaluate to either True or False
    B. The condition for an if statement must include a relational operator
    C. The condition for an if statement must include a variable that contains a value that was read from the user
    D. More than one of the above statements is correct
    E. None of the above statements is correct

Answer: _____

out of 4

22. Consider the following program:

```
x = input("Enter an integer: ")

if x < 0:
    print("That's a negative number")
else:
    print("That's a non-negative number")
```

This program is supposed to report whether or not the number entered by the user is negative or non-negative, but it is not currently working correctly. When the user enters 5, the following output is displayed (the input value entered by the user is shown in bold):

```
Enter an integer: 5
Traceback (most recent call last):
  File "number.py", line 3, in <module>
    if x < 0:
TypeError: unorderable types: str() < int()
```

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.

23. Which of the following is **not** an operator in Boolean logic?
   A. And
   B. But
   C. Or
   D. Not
   E. Xor

   Answer: _____

24. Consider the following line of code:

   if a < b or c * 5 == d – 3:

   Which operator in the preceding line has the lowest precedence? _____

out of 3

Consider the following program:

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

print("A")

if a < b:
   print("B")
   a = a + 1
elif a == b:
   print("C")
if a == b:
   print("D")
   b = b + 1
elif a < b:
   print("E")
```

25. What output is generated if the user enters 1 for a and 1 for b? _____

26. What output is generated if the user enters 1 for a and 3 for b? _____

27. What output is generated if the user enters 2 for a and 1 for b? _____

Consider the following program:

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

if a < b:
   print("A")
   a = a + 2
   if a > b:
      print("B")
   else:
      print("C")
else:
   print("D")
   a = a - 1
   if a >= b:
      print("E")
```

28. What output is generated if the user enters 1 for a and 0 for b? _____

29. What output is generated if the user enters 1 for a and 1 for b? _____

30. What output is generated if the user enters 1 for a and 3 for b? _____

31. The minimum number of test cases needed to achieve statement level test coverage for this program is:

out of 7

Consider the following program:

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

while a <= b:
  if a == 3 or a == 5:
    print("A")
    a = a + 1
  elif a == 2:
    print("B")
    a = a + 2
  else:
    print(a)
  a = a + 1
```

32. What output is generated if the user enters 2 for a and 6 for b? _____

33. What output is generated if the user enters 4 for a and 7 for b? _____

34. Consider the following program:

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

while a != 0:
  count = count + 1
  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 crashes with the following error message after the first input value is read:

```
Enter a value: 14
Traceback (most recent call last):
  File "count.py", line 4, in <module>
    count = count + 1
NameError: name 'count' is not defined
```

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.

out of 3

35. Which of the following are examples of pre-tested loops?
   A.   For Loops
   B.   While Loops
   C.   Repeat-Until Loops
   D.   Exactly two of the above answers are correct
   E.   Answers A, B and C are all correct

Answer: _____

36. Which of the follow problems would be best suited to using a nested loop?
   A.   Computing the average of a collection of numbers entered by the user
   B.   Drawing the temperature data on a climograph
   C.   Applying a color balance transformation to an image
   D.   Printing a column of numbers from 1 up to some previously defined limit
   E.   Converting a temperature from degrees Celsius to degrees Kelvin

Answer: _____

37. What values are generated when the function call $range(6, 0, -2)$ is executed?
   A.   [4, 2]
   B.   [4, 2, 0]
   C.   [6, 4, 2]
   D.   [6, 4, 2, 0]
   E.   [6, 4, 2, 0, -2]

Answer: _____

Consider the following program:

```
for i in range(3):
    a = 1
    while a < i:
        a = a + 1
        print("A")
    print("B")
```

38. What output is displayed when it runs? _____

Consider the following program:

```
a = 0
while a < 6:
    if a == 1 or a == 5:
        b = 1
        while b < 3:
            a = a * 2
            b = b + 1
        print(b)
    print(a)
    a = a + 1
```

39. What output is displayed when it runs? _____

out of 5