

# Computer Science 217

## Midterm Exam

October 29, 2018

First Name: \_\_\_\_\_

Last Name: \_\_\_\_\_

ID: \_\_\_\_\_

Class Time (Circle One):                      1:00pm                      3:00pm

### Instructions:

- Neatly print your names and ID number in the spaces provided above.
- 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).
- Neatly print your names and ID on the provided answer sheet, and shade the circles for your student ID number and class time.
- Answer question 1 in this exam booklet. Record your answers for questions 2 to 39 on the provided answer sheet.
- Pick the **best answer** for each multiple choice question.
- This exam consists of 13 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 Wednesday October 31 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 those additional questions and submitting your answers by Wednesday November 14th.

1. [12 marks] Consider the p-harmonic series:

$$\sum_{n=1}^{\infty} \frac{1}{n^p} = \frac{1}{1^p} + \frac{1}{2^p} + \frac{1}{3^p} + \frac{1}{4^p} + \frac{1}{5^p} + \frac{1}{6^p} + \dots$$

Each term in the series is calculated by dividing 1 by  $n^p$  where the  $n$  values are sequential integers and  $p$  is any non-negative number. The series converges when  $p$  is greater than 1. Otherwise the series diverges.

Create a program that allows the user to determine whether or not a target total is reached when the first 1,000 terms of the series are summed. The target total and the value of  $p$  will both be entered by the user. If the total reaches (or exceeds) the target value then your program should report such. Otherwise the program should report one of the following two messages:

- If the series diverges then the program should report that the target total can be reached, but more than 1,000 terms need to be summed to reach it
- If the series converges then the program should report that it may or may not be possible to reach the target total.

Your program should continue reading target values and  $p$  values until the user enters a target value less than or equal to zero (at which time the program should terminate). Do not read a  $p$  value if such a target value was entered.

Include appropriate prompts and output messages that are a reasonable match the sample program runs shown below. Comments are **not** required. Please select reasonable variable names when writing your program. Do **not** use break or continue in your solution. Ensure that your program behaves correctly if the first value entered by the user is less than or equal to zero.

A sample program run is shown below. The values entered by the user are shown in bold.

```
Enter the target value (zero or negative to quit): 6.6
Enter the power to which each denominator will be raised: 1
The target was reached using 1,000 terms or less.
Enter the target value (zero or negative to quit): 3.14
Enter the power to which each denominator will be raised: 1.4
It may or may not be possible to reach the target because the series converges.
Enter the target value (zero or negative to quit): 3.14
Enter the power to which each denominator will be raised: 1.3
The target was reached using 1,000 terms or less.
Enter the target value (zero or negative to quit): 1000
Enter the power to which each denominator will be raised: 0.5
The target value can be reached, but more than 1,000 terms are needed.
Enter the target value (zero or negative to quit): 1000
Enter the power to which each denominator will be raised: 0
The target was reached using 1,000 terms or less.
Enter the target value (zero or negative to quit): 0
```

Place your answer to Question #1 on this page.

2. 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. An electronic device that accepts information in digital form
  - C. A mechanical device capable of receiving and outputting information
  - D. A mechanism for performing logic and control
  - E. A tool that receives, processes and presents data
3. The type of electronic switch used to construct ENIAC was a(n):
- A. Abacus
  - B. Relay
  - C. Solder Point
  - D. Transistor
  - E. Vacuum Tube
4. Consider the following statement, known as Moore's Law:
- "The complexity for minimum component costs has increased at a rate of roughly a factor of \_\_\_\_\_ per year ... Certainly over the short term this rate can be expected to continue, if not to increase. Over the longer term, the rate of increase is a bit more uncertain, although there is no reason to believe it will not remain nearly constant for at least \_\_\_\_\_ years."
- The numbers that should be placed in the blanks to correctly state Moore's Law are:
- A. 2 and 10
  - B. 2 and 50
  - C. 10 and 2
  - D. 10 and 50
  - E. 50 and 10
5. The area of computer science that involves the design and construction of new input devices is known as:
- A. Computer Graphics
  - B. Human Computer Interaction
  - C. Information Security
  - D. Information Visualization
  - E. Software Engineering
6. In Bloom's taxonomy, which level of competence is characterized by the ability to follow a known pattern to solve a problem?
- A. Application
  - B. Comprehension
  - C. Evaluation
  - D. Knowledge
  - E. Synthesis

7. Which of the following statements is most correct?
- A. An algorithm consists of a set of steps that solve a problem
  - B. Algorithms are written in a format that a computer can read
  - C. Algorithms must be expressed using a precise syntax
  - D. Exactly two of the above answers are correct
  - E. Answers A, B and C are all correct
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
9. Python programs are normally executed using a(n):
- A. Compiler
  - B. Engine
  - C. Translator
  - D. Taxonomy
  - E. Virtual Machine
10. Which of the following names is a legal (allowed) name for a variable in Python? Note that you should only consider whether or not the variable names are legal. A name may still be legal even if it is stylistically poor.

BB8

Two-words

\_1\_2\_3

sqrt

- A. BB8 is a legal variables name. The other names are **not** legal variable names.
- B. \_1\_2\_3 is a legal variable name. The other names are **not** legal variable names.
- C. BB8 and \_1\_2\_3 are legal variable names. The other names are **not** legal variable names.
- D. BB8, \_1\_2\_3 and sqrt are legal variable names. The other names are **not** legal variable names.
- E. All of the names listed in the question are legal variable names.

11. Consider the following code segment:

```
x = 5
y = 2
z = x * y
print("z")
```

The output it generates when it executes is:

- A. 5
- B. 10
- C. 55
- D. 22222
- E. z

12. Which of the following statements is most correct?

- A. Reading the value of a Python variable changes 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 correct

13. Consider the following code segment:

```
a = input()
b = int(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. None of the above answers are correct

14. Consider the follow statement:

```
x = 2 + 3 ** 2 - 1
```

What value is stored in x when it executes?

- A. 5
  - B. 9
  - C. 10
  - D. 24
  - E. 26
15. Consider a program that runs to completion but delivers an incorrect result. The error in this program would be classified as a:
- A. Condition Error
  - B. Logic Error
  - C. Path Error
  - D. Runtime Error
  - E. Syntax Error
16. By convention, Python programmers use a name that is in ALL CAPS to denote a(n):
- A. Constant value
  - B. Error message
  - C. Function name
  - D. Reserved word
  - E. Type name
17. What form is used to store all data in computer?
- A. ASCII
  - B. Binary
  - C. Boolean
  - D. Decimal
  - E. Hexadecimal
18. The encoding standard that allows us to encode a very wide variety of characters including letters with accents, Greek symbols such as pi, and music symbols (among many others) is known as:
- A. ASCII
  - B. Extended ASCII
  - C. Extended UTF-8
  - D. Two's Complement
  - E. UTF-8

19. What base 10 value is equivalent to 356 base 7?
- A. 188
  - B. 233
  - C. 332
  - D. 881
  - E. None of the above answers are correct
20. What base 12 value is equivalent to 227 base 10?
- A.  $16B_{12}$
  - B.  $6B_{12}$
  - C.  $B16_{12}$
  - D.  $FB_{12}$
  - E. None of the above answers are correct
21. What base 16 value is equivalent to 1111010 base 2?
- A.  $2F_{16}$
  - B.  $7A_{16}$
  - C.  $A7_{16}$
  - D.  $F2_{16}$
  - E. None of the above answers are correct
22. Which of the following is **not** a valid number in base 13?
- A. 0
  - B. 13
  - C. 4D
  - D. AB
  - E. None of the above answers are correct (they are all valid numbers in base 13)
23. Which of the following is an example of relational operator?
- A. and
  - B. !=
  - C. =
  - D. \*\*
  - E. %
24. The Python data type that can only store two possible values, True and False, is known as:
- A. Binary
  - B. Boolean
  - C. Decimal
  - D. Float
  - E. Integer



25. Consider the following code segment:

```
w = True
x = 4
y = -6
z = 2
result = -(x + z) < y or x ** z < 10
print(result)
```

What is printed when it runs?

- A. -6
- B. 4
- C. 16
- D. False
- E. True

26. Consider the following code segments:

<pre># Segment 1 if x &lt; 1:     print("A") else:     print("B")</pre>	<pre># Segment 2 if x &lt; 1:     print("A")     if x &lt; 0:         print("B")</pre>	<pre># Segment 3 if x &lt; 1:     print("A") elif x &lt; 0:     print("B")</pre>	<pre># Segment 4 if x &lt; 1:     print("A") if x &lt; 0:     print("B")</pre>
---	--	--	--

Which of the preceding segments contains an example of a nested if statement?

- A. Segment 2
- B. Segment 4
- C. Segments 1 and 3
- D. Segments 2 and 4
- E. Segments 1, 3 and 4

27. Which type of statement should be used to ensure that exactly one of two statements executes?

- A. An if statement (without any elif or else parts)
- B. An if-elif statement with one elif (and no else part)
- C. An if-elif-else statement (with one elif part)
- D. An if-else statement (without any elif parts)
- E. None of the above statement types should be used to ensure that exactly one of two statements execute

28. Which of the following is **not** a type of white box test coverage:

- A. Behavioural Coverage
- B. Condition Coverage
- C. Path Coverage
- D. Statement Coverage
- E. None of the above answers are correct (they are all types of white box test coverage)

Consider the following code segment for the following 2 questions:

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

if a < 0:
    print("X")
    b = b - 1
if b < 0:
    print("Y")
```

29. Which letter(s) will be displayed if the user enters 0 for a and 0 for b?

- A. X (only)
- B. Y (only)
- C. X followed by Y
- D. Y followed by X
- E. None of the above answers are correct

30. Which letter(s) will be displayed if the user enters -1 for a and 0 for b?

- A. X (only)
- B. Y (only)
- C. X followed by Y
- D. Y followed by X
- E. None of the above answers are correct

31. Consider the following code segment:

```
a = int(input())
b = int(input())
for i in range(a, b):
    print(a)
    if i < a * 2:
        print(i)
    print(b)
print(a + b)
```

How many lines are there in the body of the for loop?

- A. 3
- B. 4
- C. 5
- D. 6
- E. 8

32. Which of the following are examples of a post-tested loop?

- A. For loop
- B. Repeat Until loop
- C. While loop
- D. Exactly two of the above answers are correct
- E. Answers A, B and C are all correct

33. Consider the following code segment:

```
for i in range(2, 4):  
    print(i)
```

What value(s) are printed when it executes?

- A. 2
- B. 3
- C. 2 and 3
- D. 3 and 4
- E. 2, 3 and 4

Consider the following code segment for the next two questions:

```
a = float(input("Enter a number: "))  
b = 3
```

```
while a < 4:  
    if b < 3:  
        b = b + 2  
    else:  
        b = b / 2  
    print(b)  
    a = a + 1
```

```
print(a)
```

34. What numbers are printed by this code segment if the user enters 0 for a?

- A. 0.0
- B. 1.0, 3.0, 1.0, 3.0 and 5.0
- C. 1.5, 3.5, 1.75, 3.75 and 4.0
- D. 1.5, 3.5, 1.75, 3.75, 1.875 and 5.0
- E. None of the above answers are correct

35. What numbers are printed by this code segment if the user enters 4 for a?

- A. 0.0
- B. 5.0
- C. 1.0 and 5.0
- D. 1.5 and 5.0
- E. None of the above answers are correct

36. Consider a program that reads your grades for all of the exercises in this course and computes your grade point average for them (including dropping your lowest grade). Assume that the user always enters correct input values so there is no need to include code that ensures that the entered values are valid letter grades. Which statement best describes the type of loop that would be used in a program that solves this problem?
- A. A for loop must be used to solve this problem
  - B. A while loop must be used to solve this problem
  - C. Both a for loop and a while loop are needed to solve this problem
  - D. Either a for loop or a while loop could be used to solve this problem
  - E. Neither a for loop nor a while loop should be used to solve this problem

Consider the following code segment for the next 2 questions:

```
a = float(input("Enter a: "))
c = 0

while a < 5:
    c = c + 1
    b = a * 2
    while b < 3:
        b = b + 1
        c = c * 2
    a = a + 1

print(c)
```

37. When the user enters 0 the output will be:
- A. 21
  - B. 22
  - C. 71
  - D. 72
  - E. None of the above answers are correct
38. When the user enters 3 the output will be:
- A. 1
  - B. 2
  - C. 3
  - D. 4
  - E. 5

39. Consider the following code segment:

```
for i in range(6):  
    print("X")  
    for i in range(8):  
        print("X")
```

How many copies of the letter X are printed when it executes?

- A. 54
- B. 63
- C. 70
- D. 84
- E. None of the above answers are correct