CMSC 104 Section 2
Fall 2025
Sample Final Exam
Answer Key

Overview:

This exam is worth a total of 200 points. Consistent with the syllabus, it will count for 30% of the semester grade.

There are three sections. Section 1 consists of 15 True/False and Multiple Choice questions, each of which is worth 5 points, for a total of 75 points. There is no partial credit awarded for questions in Section 1. Section 2 consists of 10 short answer questions, each of which is worth 8 points, for a total of 80 points. Partial credit WILL be awarded for questions in this section, so please make an effort to answer each question. Section 3 consists of 3 coding questions. Each of these is worth 15 points, for a total of 45 points, and partial credit WILL be awarded for questions in this section. Again, please make an effort to answer each question.

Instructions:

This exam is open-book, open-notes. You may use your laptop to refer to previous lecture notes, quizzes, coding assignments, etc. You may use an IDE to test code, to ensure that it works the way you intend. However, ALL answers must be written on the test paper in order to be graded.

You MAY NOT use any AI tool, such as ChatGPT, Google Gemini, Microsoft CoPilot, etc. to answer any part of any question.

You MAY NOT interact with any other student, whether inside or outside of the classroom, during this exam. That includes texting or messaging other students - that is strictly prohibited.

Section 1: True/False and Multiple Choice

1. One of these loop types is considered to be the most general loop type in Python. That is, any loop that can be written in Python can always be written as what?
    a. For each loop
    b. For i loop
    c. While loop
    d. Do-until loop

2. Order of operation
3. Suppose that you have the list school = [“U”, “M”, “C”]. If you wanted to insert the letter “B” into the list between “M” and “C”, which statement would you use?
    a. school.append(“B”)
    b. school.insert(2,”B”)
    c. school.insert(3,”B”)
    d. school.append(2, “B”)

4. Which of the following types are legal types for dictionary values in Python:
    a. Lists and dictionaries
    b. Immutable types only - Ints, floats, strings, and booleans
    c. Only ints
    d. None of the above is a correct answer

5. True or False: the last element in a list always has the index -1, because it is always equal to the length of the list -1.
    a. True
    b. False

6. Which of the following IS a legal Python variable name?
    a. `2cool4school`
    b. `we-will-win`
    c. `the_footb@ll_g@me`
    d. None of them is a legal variable name

7. True or False: a function that has no return statement will always return the special value None
    a. True
    b. False

8. If `list1 =[1,2]` and `list2=[3,4]`

What is the output of the statement `print (list1+list2)`

a. [1,2,3,4]
b. [1,2,1,2]
c. [4,6]
d. None of the above - you can't add lists in this way

9. Which of the following is part of the computer's hardware?
    a. Operating System
    b. Solid state drive (SSD) or Hard Disk Drive
    c. On-line game
    d. Printer driver

10. True or False: your operating system, such as Windows or MacOS, is considered to be system software while a computer game is considered to be application software.
    a. True
    b. False

11. What operator is used to concatenate two strings together?
    a. The minus sign (-)
    b. The comma (,)
    c. The plus sign (+)
    d. Two slashes together (//)

12. If you wanted to read the next line - one line only - from a file, which method would you use?
    a. read()
    b. readline()
    c. readlines()
    d. None of the above would work

13. What is the best way to develop software?
    a. Write a little; test a little. Like, write a function and test it. Then move on to the next function.
    b. Write the whole darned thing and hope like heck it works when you test it.
    c. Don't be ridiculous; the answer is a.
    d. I'm serious; just choose a.

14. True or False: to be valid, a recursive solution to a problem must have at least one base case, and at least one recursive case that has the effect of getting the problem close to a base case.
    a. True
    b. False

15. True or False: Encapsulation in object-oriented design means that you combine all the data and methods into a single structure, which improves security and privacy and coding efficiency.
    a. ***True***
    b. False

Section 2: Short Answer

16. Explain what a sentinel while loop is.

A loop that runs until it sees a specific value. That value is called the "sentinel"

17. Identify the parts of the function definition and call in the figure below

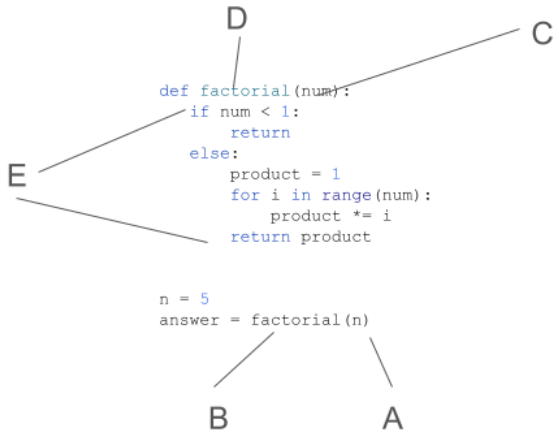
Function name:D

Function body: E

Argument list: A

Function call: B

Parameter list: C



Use the following list definition to answer questions 18 and 19:

```
states = [
   "Alabama", "Alaska", "Arizona", "Arkansas", "California", "Colorado",
"Connecticut", "Delaware", "Florida",
   "Georgia", "Hawaii", "Idaho", "Illinois", "Indiana", "Iowa", "Kansas",
"Kentucky", "Louisiana", "Maine",
   "Maryland", "Massachusetts", "Michigan", "Minnesota", "Mississippi",
"Missouri", "Montana", "Nebraska",
   "Nevada", "New Hampshire", "New Jersey", "New Mexico", "New York", "North
Carolina", "North Dakota",
   "Ohio", "Oklahoma", "Oregon", "Pennsylvania", "Rhode Island", "South
Carolina", "South Dakota",
   "Tennessee", "Texas", "Utah", "Vermont", "Virginia", "Washington", "West
Virginia", "Wisconsin",
   "Wyoming"
]
```

18. Write a Python statement that creates a new list, `end_states`, that consists of the last ten states of this list in alphabetical order

```
end_states = states[40:]  or end_states = states[40:50]
```

19. Let the list `vowels = ['a','e','i','o','u','y']`
    Using that list, print out every state name in the list states that ends with a vowel.

```
for state in states:
      if state[-1] in vowels:
            print(state)
```

20. If every problem that can be solved with recursion can also be solved with iteration, and if recursive problems are more expensive in terms of requiring more memory and more time to execute, why do we even worry about recursive programming?

Because some problems are easier for humans to understand and solve using recursion that they would be using iteration, and the humans are the slow and expensive part of problem solving.

21. Write an if-elif-else statement that will:
    - print out the message “Congratulations, grad!” if a boolean variable “grad” is True and the boolean variable “enrolled” is True
    - Print out the message “See you in January” if “grad” is False and “enrolled” is True
    - And otherwise print out the message “time to re-enroll.”
    - Don’t worry about assigning values to the two boolean variables. That would happen elsewhere in the program.

```
if grad and enrolled:
      print(“Congratulations, grad”)
elif enrolled and not grad:
      print(“See you in January”)
else:
      print(“time to re-enroll”)
```

22. What is the difference between an object and a class in Object-oriented design?

A class gives the general structure for a structure, including methods. An object is an instance of a class

23. Suppose you have a Python print( ) statement. What’s the difference between separating values that are being printed with a , and separating them with a +?
    Using the , as a separator inserts one blank space between them, while using a + concatenates them with no additional blank space between.

24. What is the Python symbol table?

A data structure that contains the names, types, and locations in memory of each symbol - that is, variable or function name - known to the program in the current scope.

25. Explain what is meant by “string slicing”

Creating a new string that contains only a subset of the characters of the original string.

Section 3: Coding

26. Write a Python program that uses a while loop to ask a user for 3 integers. That is, the program loops 3 times, each time asking for one integer. Once you have the 3 integers, print out the product of the 3 numbers, labeled so the user knows what is being printed.

```
product = 1
i = 1
while i < 4:
   num = float(input('Enter a number: '))
   product = product * num
   i = i + 1
print("the product of your numbers is: ", product)
```

27. Write a program that asks the user to input a floating point number. Then, your program must call a function to compute the square root of that number, and return it to the main program. Then the mail program prints out the answer. You can safely assume that the number will be positive and have a real square root.

    YOU MUST WRITE THE COMPLETE PROGRAM - you must show both the main program and the function.

```
def sqrt(num):
   return num ** (1 / 2)

if __name__ == "__main__":
   n = float(input("Enter a number: "))
   print("The square root of ", n, "is", sqrt(n))"
```

28. Suppose that I have a file called “usa.tsv” that consists of the 50 states of the US.. On each line is the name of the state with spaces removed, then a tab, then the name of the state capitol with spaces removed. The first five lines of the file look like this:

```
Alabama Montgomery
Alaska Juneau
Arizona Phoenix
Arkansas LittleRock
California Sacramento
```

The rest of the file looks similar.

Write a Python program that (a) reads in the contents of the file; (b) splits each line on the tab; and (c) creates a dictionary called “US” where each state name is a key, and each state capitol name is the corresponding value. That is, your dictionary looks like

```
US = {
      “Alabama”:”Montgomery”,
      “Alaska”:”Juneau”,
      “Arizona”:”Phoenix”,
…     }
```

```
US = {}
with open("usa.tsv","r") as infile:
   data = infile.readlines()
   for line in data:
       v = line.split("\t")
       US[v[0]] = v[1]
print(US)
```