

Computer Science 217

Midterm Exam

October 28, 2019

First Name: _____

Last Name: _____

ID: _____

Instructions:

- Neatly print your names and ID number in the spaces provided above.
- Neatly print your names and ID on both of the provided answer sheets, and shade the circles for your student ID number on both of the answer sheets.
- Record your answers for question 1 on the appropriate bubble sheet. Record your answers for questions 2 to 39 on the traditional 5 answer multiple choice bubble sheet.
- Ensure that any errors made when recording answers on the bubble sheets are erased completely. Additional bubble sheets are available if you are unable to completely erase your undesired response.
- Pick the **best answer** for each multiple choice question.
- 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. Extra time will **not** be provided to record your answers on the answer sheets. 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**

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

Question #1:

[12 marks] A professional photographer has discovered that the probability that a child will look good in a posed photograph is 77%. The probability that an adult will look good in a posed photograph is 95% if there no children present. This probability reduces to 86% when children are present (because the adults are worried about keeping the children looking good).

Your task is to create a program that reads the number of adults and children being photographed and reports:

- 1) The probability that taking one photo will result in a picture where everyone looks good; and
- 2) A table showing the probability that everyone looks good in at least one photograph for between 2 and 5 pictures taken.

The probability that everyone looks good in one photograph is computed as:

$$\text{prob} = (\text{adult probability})^{\text{number of adults}} * (\text{child probability})^{\text{number of children}}$$

The table that is produced should show the results for taking 2 through 5 pictures. Each row in the table should include the number of pictures and the probability that everyone looks good in at least one of the pictures. This probability can be computed as:

$$\text{prob of at least one} = 1 - (1 - \text{prob})^{\text{\# of pictures}}$$

The program should continue reading the number of adults and the number of children from the user until the number of adults is less than 0, the number of children is less than 0, or the total number of people in the picture is less than 1.

Two sample runs for the program are shown below. The program that you create should generate output that matches what is shown below.

Sample Run #1:

```
Enter the number of adults: 0
Enter the number of children: 0
```

Sample Run #2:

```
Enter the number of adults: 2
Enter the number of children: 2
Probability for 1 pic: 0.43850883999999996
# Pics  Probability
    2   0.684728
    3   0.822977
    4   0.900603
    5   0.944190
Enter the number of adults: 0
Enter the number of children: 3
Probability for 1 pic: 0.456533
# Pics  Probability
    2   0.704644
```

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3 0.839484

4 0.912765

5 0.952590

Enter the number of adults: 1

Enter the number of children: 0

Probability for 1 pic: 0.95

Pics Probability

2 0.997500

3 0.999875

4 0.999994

5 1.000000

Enter the number of adults: -1

Enter the number of children: 3

Use the following lines to construct your solution. Record your answer onto the provided bubble sheet.

1: adult_prob = 0.86

2: adult_prob = 0.95

3: adults = int(input("Enter the number of adults: "))

4: atleast_one = 1 - (1 - prob) ** num_pics

5: atleast_one = 1 - (1 - prob) ^ num_pics

6: children = int(input("Enter the number of children: "))

7: else:

8: for num_pics in range(0, 5):

9: for num_pics in range(1, 5):

12: for num_pics in range(2, 6):

13: if children < 0:

14: if children == 0:

15: if children > 0:

16: print("# Pics Probability")

17: print("%6d %f" % (num_pics, atleast_one))

18: print("Probability for 1 pic:", prob)

19: prob = adult_prob ** adults * 0.77 ** children

23: prob = adult_prob ^ adults * 0.77 ^ children

24: total = adults + children

25: while adults >= 0 and children >= 0 and total >= 1:

26: while adults >= 0 or children >= 0 or total >= 1:

Answer the questions on this page on the provided answer sheet.

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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. A mechanical device capable of receiving, processing and 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

3. Charles Babbage wanted to construct his difference engine to aid with:
 - A. Nuclear reaction calculations
 - B. The creation of logarithmic and trigonometric function tables
 - C. The production of artillery firing tables
 - D. The tabulation of census and election results
 - E. Weather forecasting

4. Consider the following statement:

“The complexity for minimum component costs has increased at a rate of roughly a factor of two 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 10 years.”

It is known as:

 - A. Bloom’s Law
 - B. Boole’s Law
 - C. Dijkstra’s Law
 - D. Gates’s Law
 - E. None of the above answers are correct

5. Which of the following levels of competence in Bloom’s taxonomy indicates the least level of capability in a subject area?
 - A. Analysis
 - B. Application
 - C. Consideration
 - D. Evaluation
 - E. Synthesis

6. The result produced by top down design is:
 - A. An algorithm
 - B. A circuit
 - C. A computer program
 - D. A logical expression
 - E. A mathematical expression

Answer the questions on this page on the provided answer sheet.

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7. The area of computer science that develops techniques for modelling problems so that many people can work on a solution simultaneously is:
 - A. Artificial intelligence
 - B. Distributed systems
 - C. Human computer interaction
 - D. Software engineering
 - E. Theory of computation
8. When creating a new piece of software to solve a problem with a computer, the first step is to:
 - A. Analyze the problem, breaking it into pieces
 - B. Gain necessary knowledge about the problem domain
 - C. Run the program
 - D. Write the code for the program
 - E. Validate the program results
9. Which of the following levels of abstraction includes the most details?
 - A. High level programming languages
 - B. Human languages
 - C. Low level programming languages
 - D. Machine language
 - E. Python programming language
10. A named location in memory that holds a value that can change over time is known as a(n):
 - A. Assignment
 - B. Comment
 - C. Constant
 - D. Expression
 - E. Variable
11. What type of value is returned by the `input` function?
 - A. Character
 - B. Floating-point number
 - C. Integer
 - D. String
 - E. The type of the value returned varies depending on what was entered by the user
12. In Python the `//` operator denotes
 - A. Exponentiation
 - B. Formatting
 - C. Line continuation
 - D. Remainder
 - E. None of the above answers are correct

Answer the questions on this page on the provided answer sheet.

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13. An error in a program which causes it to produce incorrect results without displaying an error message is known as a(n):

- A. Infinite loop
- B. Logic Error
- C. Off by one error
- D. Runtime error
- E. Syntax error

14. Consider the following program:

```
print(int("2" * "4"))
```

What value is displayed when it executes?

- A. 8
- B. 24
- C. 44
- D. 2222
- E. None of the above answers are correct

15. Consider the following program:

```
a = int(input())  
b = a + 3 / 2 - a  
print(b)
```

What value does it displayed when it executes if the user enters 2?

- A. 0
- B. 0.5
- C. 1.5
- D. 2
- E. None of the above answers are correct

16. Which of the following statements displays the value of x so that it includes 4 digits to the right of the decimal point?

- A. `print("%.4f" % x)`
- B. `print("%.4f", x)`
- C. `print("%.4x")`
- D. `print(x % "%.4f")`
- E. `print(x, "%.4f")`

17. The process of transforming information into data that can be processed by a computer is known as:

- A. Compiling
- B. Encoding
- C. Laminating
- D. Translating
- E. Transliterating

**Answer the questions on this page on the provided answer sheet.
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18. The type of data that has two possible values, true and false, is known as
- A. Binary data
 - B. Bit data
 - C. Boolean data
 - D. Floating-point data
 - E. Secondary data
19. 1011 in binary is equivalent to:
- A. 10 in base 11
 - B. 11 in base 10
 - C. B in base 16
 - D. Exactly two of the above answers are correct
 - E. Answers A, B and C are all correct
20. 242 base 5 is equivalent to:
- A. 24_{10}
 - B. 27_{10}
 - C. 42_{10}
 - D. 72_{10}
 - E. None of the above answers are correct
21. 179 base 10 is equivalent to:
- A. $12B_{12}$
 - B. $B12_{12}$
 - C. $B21_{12}$
 - D. 1112_{12}
 - E. 1211_{12}
22. How many characters are defined by the ASCII character encoding system?
- A. $2^0 = 1$
 - B. $2^7 = 128$
 - C. $2^8 = 256$
 - D. $2^{16} = 65536$
 - E. $2^{24} = 16777216$
23. Which of the following statements is most correct?
- A. An image that is represented as a collection of pixels in a grid is known as a line art or vector image
 - B. Floating-point numbers can represent every real number within a limited range
 - C. UTF-8 is a variable length character encoding system
 - D. Exactly two of the above answers is correct
 - E. Answers A, B and C are all correct

Answer the questions on this page on the provided answer sheet.

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24. Assume that x and y have each been initialized to integer values. Which of the following is a valid condition for an if statement?

- A. $x > y$
- B. $x \% y$
- C. $x = y$
- D. Exactly two of the above answers are correct
- E. Answers A, B and C are all correct

25. Consider the following truth table.

a	b	Column A	Column B	Column C	Column D	Column E
False	False	False	False	False	True	True
False	True	True	True	True	False	False
True	False	True	False	False	False	True
True	True	False	True	True	True	False

Which column shows the correct combination of True and False values for the expression $a \text{ xor } b$?

- A. Column A
- B. Column B
- C. Column C
- D. Column D
- E. Column E

26. Consider the following code segment which is supposed to determine and display whether water is ice, liquid water, or water vapour. However, it may contain a bug.

```
temp_c = float(input("Enter a temperature in degrees C: "))
```

```
if temp_c < 0:                                # Line 1
    print("It's ice!")
elif temp_c >= -10 and temp_c < 100:         # Line 2
    print("It's liquid water!")               # Line 3
else temp >= 100:                             # Line 4
    print("It's water vapour!")               # Line 5
```

Which of the following corrections must be performed so that the program will perform its intended purpose?

- A. Replace $<$ with $>$ on Line 1
- B. Remove " $\text{temp_c} \geq -10$ and" on Line 2
- C. Swap Line 3 and Line 5
- D. Remove " $\text{temp} \geq 100$ " on Line 4
- E. No correction is necessary – the program already functions as required

Answer the questions on this page on the provided answer sheet.

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27. Consider the following expression:

$x < 3$ or $y * 5 \neq 5 + 2$

When it is evaluated the last operator that is evaluated is:

- A. \neq
- B. $*$
- C. $+$
- D. $<$
- E. or

28. Consider the following code segment:

```
x = int(input())
y = int(input())
```

```
if x <= 0:
    print("X")
if y >= 0:
    print("Y")
print("Z")
```

If the user enters 0 for x and 0 for y then the letters displayed by the program will be:

- A. X and Z
- B. X, Y and Z
- C. Y and Z
- D. Z
- E. None of the above answers are correct

29. The process of carefully examining the statements in a program and recording the values of its variables as they change in order to determine its output by hand is known as:

- A. Drawing
- B. Screening
- C. Surveilling
- D. Tagging
- E. Tracing

Answer the questions on this page on the provided answer sheet.

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Consider the following code segment for the following 3 questions:

```
q = int(input())
r = int(input())

if q < -1 or q > 1:
    q = q + 1
    if r > 0:
        q = q + 1
    elif q > 2:
        r = r - 1
elif r < 0:
    r = r - 1

print(q, r)
```

30. What is printed by this code segment if the user enters 2 for q and 2 for r?

- A. 2 1
- B. 2 2
- C. 3 1
- D. 4 1
- E. 4 2

31. What is printed by this code segment if the user enters 2 for q and 0 for r?

- A. 3 -1
- B. 3 -2
- C. 4 -1
- D. 4 -2
- E. None of the above answers are correct

32. What is printed by this code segment if the user enters -2 for q and -2 for r?

- A. 0 -2
- B. 0 -3
- C. -1 -2
- D. -1 -3
- E. -2 -2

33. Which of the following types of loops are pre-tested loops?

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

Answer the questions on this page on the provided answer sheet.

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34. The error that occurs when a loop body runs one time too many or one time too few is known as a(n):

- A. Off-by-one error
- B. Plus-minus error
- C. Relational operator error
- D. Syntax error
- E. Value error

35. Consider the following program:

```
i = int(input())
while i > 1:
    if i % 2 == 0:
        i = i / 2
    else:
        i = i - 1
    print("A")
```

How many copies of the letter A are printed when the program runs if the user enters 7?

- A. 1
- B. 2
- C. 3
- D. 4
- E. None of the above answers are correct

36. Consider the following program:

```
i = 5
while i >= 1:
    print("X")
    i = i - 1
    for j in range(10):
        print("X")
```

How many copies of the letter X does it print?

- A. 6
- B. 30
- C. 55
- D. 60
- E. None of the above answers are correct

Answer the questions on this page on the provided answer sheet.

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37. Consider the following program:

```
for i in range(2, 5):
    k = 1
    if i == 2 or i == 4:
        for j in range(i):
            k = k * i
    elif i == 3 or i == 5:
        j = i
        while j > 1:
            k = k * j
            j = j - 1
    print(k)
```

The values that it displays are:

- A. 4, 6 and 256
- B. 4, 6, 256 and 120
- C. 8, 6 and 1024
- D. 8, 6, 1024 and 120
- E. None of the above answers are correct

Consider the following program for the next two questions:

```
a = int(input())
i = 2
while i < a:
    for j in range(0, i - 2, 2):
        print("A")
        if i + j == 2 or i + j == 4:
            print("A")
            i = i + 1
    i = i + 1
    print("B")
```

38. How many Bs are printed if the user enters 4?

- A. 1
- B. 2
- C. 3
- D. 4
- E. None of the above answers are correct

39. How many As are printed if the user enters 5?

- A. 1
- B. 2
- C. 3
- D. 4
- E. None of the above answers are correct