

MA1008 Introduction to Computational Thinking Quiz 1

Answer all the nine questions in the spaces provided

AY 2021/2022, Semester 2, Week 5

Your Name: _____ Group: _____

Solutions

1. Show your workings in answering the following questions. (4 marks each)

If a student doesn't show the workings, deduct 2 marks per question, as they are likely to have got the answer from a calculator.

- i. Write the decimal integer 307 in binary.

$$307 = 256 + 32 + 16 + 2 + 1 = 2^8 + 2^5 + 2^4 + 2^1 + 2^0$$

Hence the binary number is 100110011.

- ii. Write the decimal integer 307 in hexadecimal. Partitioning 100110011 into groups of 4 from the right gives 1|0011|0011, which gives 133 in hexadecimal.

- iii. What is the decimal value of the binary number 101101101?

$$\text{This binary is } 2^8 + 2^6 + 2^5 + 2^3 + 2^2 + 2^0 = 256 + 64 + 32 + 8 + 4 + 1 = 365.$$

2. For each of the following expressions, state (a) the result and (b) its data type. If an error exists, then correct the error and then provide the answer according to your correction. (4 marks each)

- i. `25 and 8 % 4 or "False"`

(a) True. "False" is also correct. (b) Boolean.

- ii. `18 // 2.0 - 3 ** int(2.5)`

(a) 0.0, (b) float

- iii. `"3 days =" + "day " * 3.0` (a) Error in 3.0, can't multiply string with float. Change 3.0 to integer 3. Outcome: "3 days =day day day ". Note the spaces. (b) string.

3. What are printed in the following programs: (5 marks each)

i.

```
x = 2
for i in range(3, 30, 8):
    print(x)
    if x > 15:
        break
    x += i
```

 2
5
16

ii.

```
y = 100
for j in range(50, 5, -10):
    print(y, end = ",")
    if y < 50:
        continue
    y -= j//2
```

 100, 75, 55, 40, 40,

4. The variable `V` stores a positive floating point number. Write Python statements that use `V` to produce two integers, `A` and `B`, `A` stores the integer formed by the first two digits after the decimal point and `B` stores the integer before the decimal point. If there is only one digit in the decimal part, then assume that the second digit is 0. Three examples: if `V = 2.4`, then `A = 40`, `B = 2`; if `V = 66.39`, then `A = 39`, `B = 66`; if `V = 143.088`, then `A = 8` and `B = 143`. (10 marks)

```
V = 21.40
B = int(V)
A = int((V-B)*100)
```

Some students may do `V//1` to get the integer before the decimal point. But this is not quite correct because the outcome is a float. If they don't fix that problem, then deduct 2 marks.

5. i. Given the infinite summation series

$$S = 1 + \sum_{i=0}^{\infty} \frac{1}{(i+1)(i+2)}$$

write a Python `while` loop that evaluates the series accurate to 6 decimal places. You don't need to print the result. (8 marks)

```
eps = 1e-6
S = 0
i = 0
term = 1
while term > eps:
    S += term
    i += 1
    term = 1/(i*(i+1))
```

- ii. A `for` loop is not suitable for performing the same task. Why? (4 marks)

A `for` loop is not suitable because we do not know how many terms are required to arrive at the 6 decimal places accuracy. Therefore we cannot set the range for the loop.

6. In international athletics, a male athlete qualifies for the 100m race if he is ranked in the top three in his country for the event and has completed a race in 12 seconds or less in the past 6 months. A female athlete must also be ranked in the top three in her country and has run a race in 14 seconds or less in the past 6 months. The four variables `gender`, `rank`, `time` and `months` store the relevant data of an athlete. Using these variables, write one single Boolean expression that returns `True` if an athlete qualifies based on the said criteria and `False` otherwise. For `gender`, male is denoted by "M" and female by "F". (10 marks)

```
(gender=="M" and rank <= 3 and time <= 12 and months <= 6) or
(gender=="F" and rank <= 3 and time <= 14 and months <= 6)
```

Note: can do without the brackets.

7. Given an expression such as `3 + 5 * 2`, we may place round brackets in it to show the order of evaluation of the operations thus: `(3 + (5 * 2))`. Place brackets in the following expressions to show the order of evaluation of the operations. Note: There must be a pair of brackets for every operator in the expression, including logical and comparison operators. You may assume that the variables carry appropriate values.

- i. `((A / B) + (((C ** D) % (E ** F)) * G)) - H` (6 marks)

- ii. `((P and Q) or ((R > (S + T)) and (not (U <= (V // W)))))` (6 marks)

8. The program below reads in 100 numbers and prints the average of the numbers divisible by 3. But there are errors, including syntax and logical errors, omissions and redundancies. Rewrite the program correctly. (12 marks)

<pre> for i in range(1, 100): num = input(Next number:) if num // 3 = 0: sum3 += num else: continue print(Average = sum3/100) </pre>	<pre> sum3 = 0 n = 0 # for counting the 3's for i in range(1, 101): num = int(input("Next number:")) if num % 3 == 0: sum3 += num n += 1 print("Average =", sum3/n) #no indent </pre> <p>Note: else continue is redundant and should be removed. If a student includes the check for n == 0 before print, great. It's OK if not, don't deduct marks.</p>
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9. Given the number of rows, the following program prints an isosceles triangular pattern of successive two-digit odd numbers starting from 11, with the first row containing only one number and every subsequent row containing two more numbers than the previous. One space character separates two numbers. Below are two examples:

<p>Number of rows = 3</p> <pre> 11 11 13 15 11 13 15 17 19 </pre>	<p>Number of rows = 4</p> <pre> 11 11 13 15 11 13 15 17 19 11 13 15 17 19 21 23 </pre>
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Fill in the blanks to complete the program.

(10 marks)

```

n = int(input("Number of rows = "))

for i in range(1, n+1):    # go through each row

    print(" "*(3*(n-i)), end="") # print leading spaces

    for j in range(i*2-1):    # for each number in the row

        print(j*2+11, end = " ") # print the number + space

    print()    # print a new line

```

<> <> <> **THE END** <> <> <>