

Birkbeck
(University of London)

BSc/FD EXAMINATION

Department of Computer Science and Information Systems

Introduction to Programming (BUCI007H4)

CREDIT VALUE: 15 credits

Summer 2020

On Line Version

Date of examination: TUESDAY 26th MAY 2020

Duration of paper: 14:00 – 18:00

The programming language is Python.

There are **ten** questions in this paper.

Answer all **ten** questions.

Each question carries **10** marks in total.

The examination is open book.

No supplementary material is provided.

This paper is not prior disclosed.

The quote marks for strings are in this style "string" or 'string'.

The marking scheme favours the understanding of the material, the correctness of any working and the quality of argument.

1. (a) Write down the result of running the following Python code. Justify your answers. (5 marks)

- i) `print(len('9yth0\\ \\n'))`
- ii) `print('3\4')`
- iii) `len("4-1") = 3`
- iv) `print(3*"ab"*2)`
- v) `print("He said, 'No!')`

- (b) Which of the following are rejected by the compiler as names of variables? Specify the reason why they are accepted or rejected. (5 marks)

- i) `6packs`
- ii) `state-of-the-art`
- iii) `While`
- iv) `_30` # One underscore, followed by 30
- v) `true`

2. Consider the following code. (10 marks)

```
a = -2
b = 7
c = -5
d = 5
e = 3.5
a = b ** (a - c) - a * b
b = abs(-89 // b + 2) / 5
c = sqrt(c - 3 * -7) ** 4
d = 1000 % (d - 3) ** 3 ** 2
e = min(max(0.99, -3, 2E-2), max(-6, abs(-45/e) ), max(-3, -1))
```

What are the values of **a**, **b**, **c**, **d** and **e** after the above code is executed? Write down the step-by-step results of all the calculations. A correct answer without calculation details will not be awarded any marks.

3. (a) Consider the following code.

```
def num_func (number):  
    temp = number  
    rev = 0  
    while number > 0:  
        dig = number % 10  
        rev = rev * 10 + dig  
        number = number //10  
    if temp == rev:  
        return True  
    else:  
        return False
```

Explain what `num_func` does. In other words, when it will return `True` and when it will return `False`? (4 marks)

- (b) Write a Python program to find a three-digit number `x`, where `num_func(x)` will return `True` and when adding 2020 to `x`, the resulting number will also get a `True` from the `num_func` function. You should provide both the Python program and the number `x` in your answer. (6 marks)

4. (a) At the self-checkout, a user is about to purchase a product. Write Python code to prompt the user with three strings: **(6 marks)**

"Please enter the name of the product:"

"Please enter the price of the product:"

"Please enter the quantity of the product:"

Give reasonable variable names to each of the inputs. If the item name is "cigarette" or "alcohol", the age of the customer will be asked. If customers are allowed to purchase the item, print out the result in the following form:

The total price to purchase product XXX is £YYY.

Otherwise print out a message

"You should be at least 18 years old to purchase the item."

- (b) Define a function `first_last` that takes in two non-empty strings as parameters. It repeats the first character of the first parameter for n times, where n is the length of the first parameter. It then repeats the last character of the second parameter for m times, where m is the length of the second parameter. The function returns the concatenation of the two results. For example,

`first_last("Hello", "bye?")` returns a string "HHHHH????". **(2 marks)**

- (c) Write down four different ways to get the underlined character "a" in the following list. You may use positive and negative indices.

`furniture = ["Table", "Chair", "Bed", "Sofa", "Wardrobe"]` **(2 marks)**

5. `products` is a list. Each member of `products` is another list specifying the name, price, quantity and discount of an individual product. For example,

```
products = [ ["Water bottle", 4.99, 200, 30],  
            ["spoon", 1.49, 153, 15],  
            ["Dessert plate", 12.99, 1009, 12.5] ]
```

Product names are of string type, prices and discount are of float type, and quantity is of int type. The longest name in `products` has is "Dessert plate", the highest price in `price` is 230.99, the largest quantity is 2400 and the highest discount is 50.0.

Write down a Python program to print all the product information in the following form:

```
Water bottle _|_0004.99_|_200_|_30.0%  
Spoon _____|_0001.49_|_153_|_15.0%  
Dessert plate_|_0012.99_|_1009_|_12.5%
```

_ indicates one space. Leave one space before and after the column separator |. (10 marks)

6. (a) Let `a`, `b`, `c` be variables such that `a` has the value `False`, `b` has the value `True` and `c` has the value `True`. Use the truth tables for `and` and `or` to evaluate the expression

`(a or b) and ((b and c) or c)`

Describe the calculation in detail. (4 marks)

- (b) Evaluate the following expressions in which `x` has the value 5 and `s` is the string with value "123". In each case state whether the result is `True` or `False`. Justify your answers.

- i) `3 != 8//4`
- ii) `1 < x < 3`
- iii) `s == "12"`
- iv) `s[-1] > "1"`

(2 marks)

- (c) Use the truth table for `or` to show that `True or y` can be evaluated even if the truth value of `y` is unknown. Similarly, use the truth table for `and` to show that `False and z` can be evaluated even if the truth value for `z` is unknown. Justify your answers.

(4 marks)

7. (a) Consider the two following snippets of Python code.

```
# code 1
if flag :
    print(True)
else :
    print(False)
print("check if statement")
```

```
# code 2
if flag :
    print(True)
else :
    print(False)
print("check if statement")
```

- i)* Describe the calculations that are carried out if code 1 is executed with `flag` equal to `True`.
- ii)* Describe the calculations that are carried out if code 1 is executed with `flag` equal to `False`.
- iii)* Describe the calculations that are carried out if code 2 is executed with `flag` equal to `True`.
- iv)* Describe the calculations that are carried out if code 2 is executed with `flag` equal to `False`.

(4 marks)

- (b) In an elevator simulation the variables `floor` and `maxFloor` have integer values. The following values of `floor` are allowed: any integer in the range 1 to `maxFloor` inclusive, with 13 and 14 both omitted. Define a function called `check` that takes `floor` and `maxFloor` as arguments and returns `True` if `floor` has an allowed value. In all other cases `check` returns `False`. (4 marks)
- (c) Rewrite the function `check` to obtain a new function `check1` with `maxFloor` as the only argument. The function `check1` prompts for the value of `floor` using the function `input`. Once the value of `floor` is obtained, `check1` makes a function call to `check` and returns the result of the function call. (2 marks)

8. (a) State the sequence of values of n that is printed when the following code is executed in a correct Python program.

```
n = 6
for i in range(4) :
    if n%3 == 0 :
        n = n//3
    else :
        n = 2*n+1
print(n)
```

(4 marks)

- (b) Write a function f that takes a list L of integers as a parameter. The function f returns the largest value of the integer i such that $L[i]$ equals $L[i+2]$. If no such integer exists, then f returns -1 . (6 marks)

9. (a) Consider the following function.

```
def main(n) :           # line 1
    sum = 0             # line 2
    i = 0               # line 3
    while i < n :      # line 4
        sum = sum+i    # line 5
        i = i+1        # line 6
    print(sum)         # line 7
```

Identify the local variables in `main` and describe the scope of each one. (6 marks)

- (b) State what is printed if the function `main` is called with the argument `2`. Justify your answer. (4 marks)

10. (a) The list `ls` is defined by `ls = [6, 3, 1]`. State all of the values of the index `i` such that `ls[i]` can be evaluated without error. (2 marks)
- (b) Evaluate `ls[-ln[ls]]`. (2 marks)
- (c) Let `w` be a list of length 3 such that each element of `w` is a list of integers of length 3. The elements `w[0][0]`, `w[1][1]`, `w[2][2]` form the diagonal. Write a function `g` that takes `w` as a parameter and that returns the sum of the elements of `w` not on the diagonal. (6 marks)