THE UNIVERSITY OF AUCKLAND

SUMMER SEMESTER, 2020
Campus: City

COMPUTER SCIENCE

Principles of Programming

(Time Allowed: TWO hours)

NOTE:
You must answer **all** questions in this exam.
No calculators are permitted.
Answer in the space provided in this booklet.
There is space at the back for answers which overflow the allotted space.

Surname	
Forenames	
Preferred Name **(if different to forenames)**	Model Answers
Student ID	
Username	

Q1 (/12)	**Q4** (/16)	**Q7** (/10)
Q2 (/20)	**Q5** (/12)	**TOTAL**
Q3 (/18)	**Q6** (/12)	

Question 1 (12 marks)

a) In the docstring of the program below, add a short description (15 words or less) of what the program does.

```
 """
This program prints the highest digit in the
number 234.

 """
 def process_digits(number):
     digits = str(number)
     result = -1
     for digit in digits:
         if int(digit) > result:
             result = int(digit)

     return result

 def main():
     print(process_digits(234))

 main()
```

(6 marks)

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b) Rewrite the following function using descriptive variable and function names.

```
def who_knows(something):
    for xxxx in range(len(something) - 1, -1, -1):
        a_thing = something[xxxx]
        if a_thing < 0:
            something.pop(xxxx)
```

```
def remove_negatives(numbers_list):
    for i in range(len(numbers_list)-1, -1, -1):
        number = numbers_list[i]
        if number < 0:
            numbers_list.pop(i)
```

(6 marks)

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Question 2 (20 marks)

a) Give the output produced when the following program is executed.

```
def main():
    print("A", end = " ")
    do1()

def do1():
    do3()
    print("B", end = " ")
    do2()

def do2():
    print("C", end = " ")

def do3():
    do2()
    print("D", end = " ")

main()
```

```
A C D B C
```

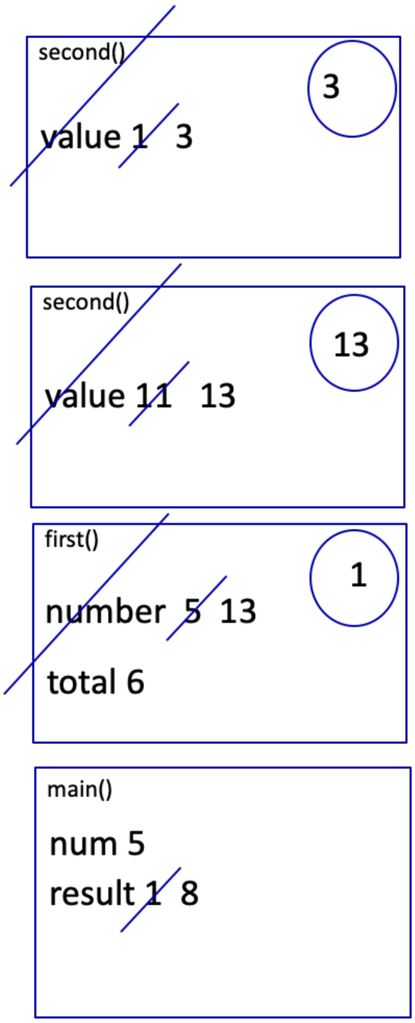
(6 marks)

b) Using the code trace technique taught in lectures, perform a code trace on the following program and show the output.

```
def first(number):
    total = 6
    number = second(number + total)
    print("1.",  number)
    return number % 3

def second(value):
    print("2.", value)
    if value % 2 == 0:
        value = value + 3
    else:
        value = value + 2
    return value

def main():
    num = 5
    result = first(num)
    print("3.",  result)
    result = second(result) + num
    print("4.",  result)

main()
```

The output:

```
2. 11
1. 13
3. 1
2. 1
4. 8
```



(14 marks)

Question 3 (18 marks)

a) Complete the output produced when the following `main()` function is executed.

```
def main():
    a_list = [1, 4, 3]
    do_something1(a_list)
    print("a_list:", a_list)

def do_something1(list1):
    list2 = list1
    extras = [2, 1, 4]
    for element in extras:
        list2.append(element)
```

```
a_list: [1, 4, 3, 2, 1, 4]
```

(6 marks)

b) Complete the output produced when the following `main()` function is executed.

```
def main():
    a_list = [3, 7]
    do_something2(a_list)
    print("a_list:", a_list)

def do_something2(list1):
    list2 = [4, 3]
    for element in [2, 5]:
        list1.append(element)
    list1 = list2
```

```
a_list: [3, 7, 2, 5]
```

(6 marks)

c) Given the following code, what is the type of the three Python objects: `object1`, `object2` and `object3`?

```
a_list = [1, '457', 4, 'True']
a_dict = {"strangely": 2, "happy": 4}

object1 = a_list[2] / 2
object2 = [a_list.pop(2) == a_dict["happy"]]
object3 = len(a_list[1] * 3) * a_dict["strangely"]
```

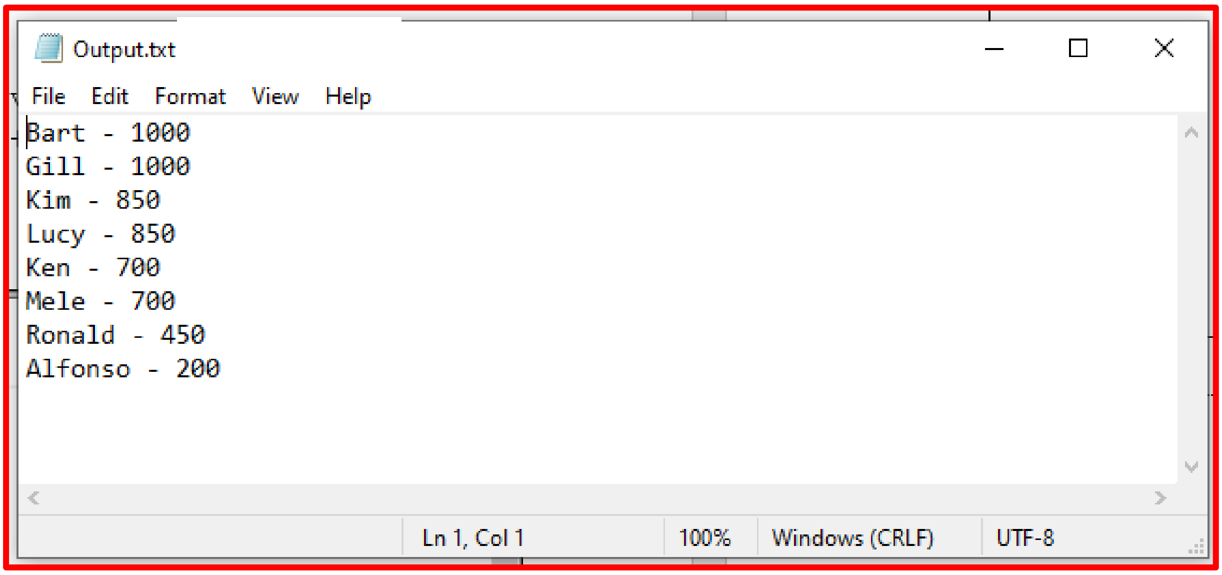
```
object1: float

object2: list

object3: int
```

(6 marks)

Question 4 (16 marks)

a) What are the contents of the file "**Output.txt**" after the following program is run?

```
def main():
    data_dict = {850:["Kim", "Lucy"], 700:["Ken", "Mele"],
                 450:["Ronald"],1000:["Gill", "Bart"],
                 200:["Alfonso"]}
    filename = "Output.txt"
    write_data(filename, data_dict)

def write_data(filename, data_dict):
    key_list = list(data_dict.keys())
    key_list.sort()
    key_list.reverse()
    output_stream = open(filename, "w")
    for key in key_list:
        values = data_dict[key]
        values.sort()
        for value in values:
            output_stream.write(value + " - " + str(key)
                                + "\n")
    output_stream.close()

main()
```



```
Bart - 1000
Gill - 1000
Kim - 850
Lucy - 850
Ken - 700
Mele - 700
Ronald - 450
Alfonso - 200
```

(9 marks)

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b) Give the output produced when the following `main()` function is executed. Show all your working.

```
def main():
    number = 0
    for i in range(5):
        number += 1
        for j in range(i):
            number += 1
        print(number)
```

```
1
3
6
10
15
```

(7 marks)

Question 5 (12 marks)

a) Consider the function below named `get_code()` that takes a string as a parameter and returns a code consisting of 3 unique characters chosen from the parameter at random. The same character does not appear in the code more than once. The parameter string has more than 3 characters and contains no repeated letters.

For example, the following statement:

```
print(get_code('ABCDE'))
```

could possibly produce:

```
DEA
```

The variable names in this function have not been chosen using good style considerations.

Rewrite the function in the answer box below using descriptive variable names that conform to the style guidelines outlined in lectures and labs:

```
def get_code(w):
    a = ''
    for i in range(3):
        p = random.randrange(0, len(w))
        a += w[p]
        w = w[0:p] + w[p+1:]
    return a
```

```
def get_code(letters):
  code = ""
  for count in range(3):
     position = random.randrange(0, len(letters)):
     code += letter[position]
     letters = letters[0:position]
             + letters[position+1:]
    return code
```

(6 marks)

b) Consider the function below named `swap_halves(numbers)` which takes a list of integers as a parameter and returns a new list that has every element in the second half of the original list swapped with every element in the first half of the original list.

```
def swap_halves(numbers):
    mid = len(numbers)//2
    return numbers[mid:] + numbers[0:mid]
```

In the box below, write **two** doctests for the `swap_halves()` function - one that **fails** the test and one that **passes** the test.

```
def swap_halves(numbers):
```

```
    """
    >>> swap_halves([0,1])
    [1,0]

    >>> swap_halves([1,2,4,5])
    [5,4,1,2]
    """
```

(6 marks)

```
    mid = len(numbers)//2
    return numbers[mid:] + numbers[0:mid]
import doctest
doctest.testmod()
```

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Question 6 (12 marks)

a) Assume that the variable, `value`, has been initialised to some integer value. Write a boolean expression which tests if `value` is exactly between 2 and 12 (both inclusive).

```
value >= 2 and value <= 12
```

(3 marks)

b) Assume that the variable, `value`, has been initialised to some integer value. Write a boolean expression which tests if `value` is exactly divisible by 13 but not divisible by 5.

```
value % 13 == 0 and value % 5 != 0
```

(3 marks)

c) Assume that the string variable, `city`, has been initialised to some value. Write a boolean expression which tests if `city` is either “Gore” or “Auckland” or “Dunedin”.

```
city == "Gore" or city == "Auckland"
or city == "Dunedin"
```

(3 marks)

d) Assume that the string variable, `word`, has been initialised to some value. Write a boolean expression which tests if `word` contains the letter “b” and does not contain the letter “d”.

```
"b" in word and "d" not in word
```

(3 marks)

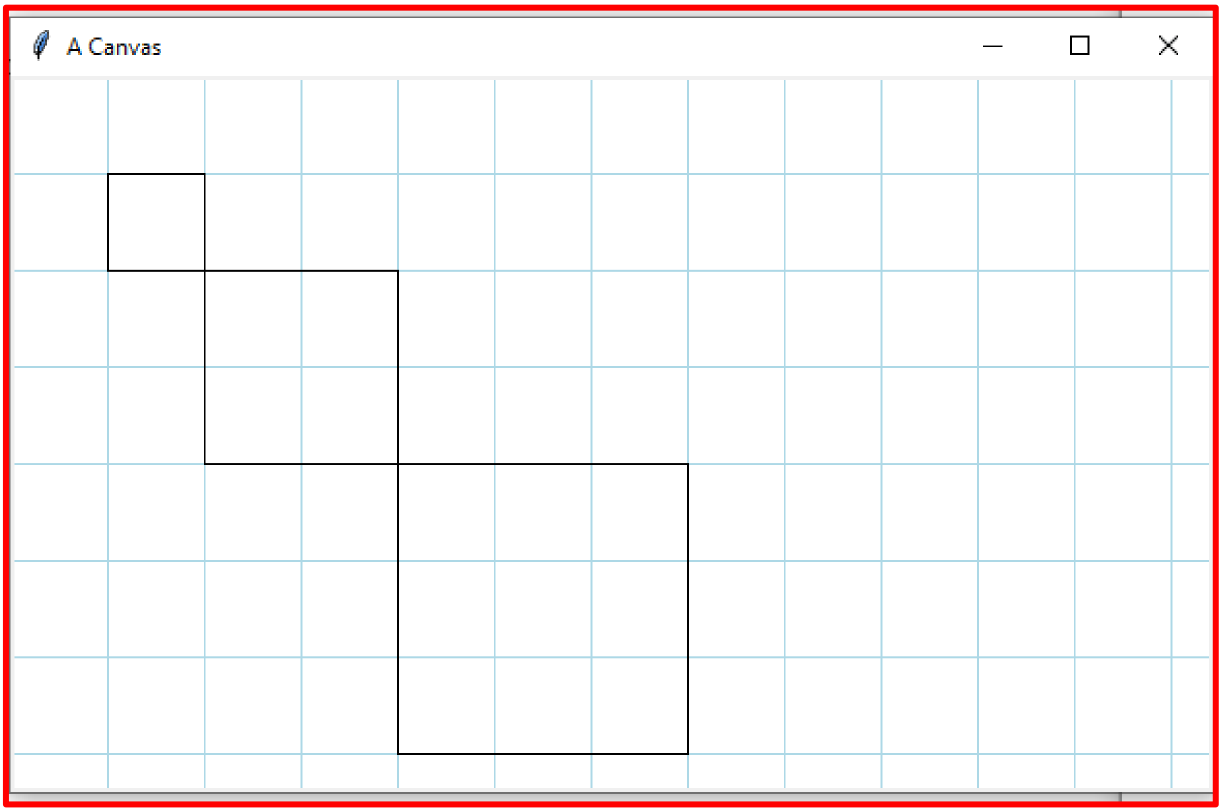
Question 7 (10 marks)

As accurately as possible, in the window below, show what is drawn when the following program is executed. The grid lines have been drawn in the window to help you. The gap between adjacent gridlines is 10 pixels.

```
def draw_pattern(a_canvas, left, top, size):
    number_of_shapes = 3
    for count in range(number_of_shapes):
        rect = (left, top, left + size, top + size)
        a_canvas.create_rectangle(rect)
        left = left + size
        top = top + size
        size = size + 10

def main():
    ...
    draw_pattern(a_canvas, 10, 10, 10)
    window.mainloop()

main()
```



(10 marks)

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(If you have used this page, please indicate clearly under the relevant question that you have overflowed to this page)