THE UNIVERSITY OF AUCKLAND

Semester One, 2019
Campus: City

TEST

COMPUTER SCIENCE

Principles of Programming

(Time Allowed: 75 Minutes)

NOTE:
- You must answer **all** questions in this test
- Calculators are **NOT** permitted.
- Answer all questions in the space provided in this booklet
- There is space at the back for answers that overflow the allotted space.

Surname	**Model Answers**
Forenames	
Preferred name	
Student ID	
Username	
Lab Time	

Question	Mark	Out Of
1		25
2		25
3		25
4		25
Total		100

ID: ………………

Question 1 (25 marks)

a) What is the output of the following code?

```
var1 = 3
var2 = 11
var3 = var1 * 2 + var2
var1 = var3 % var2 * var1
var2 = var1 // var2 + var3
var3 = (var1 - var2) / var3
print("Var1:", var1, "\nVar2:", var2, "\nVar3:", var3)
```

Var1: 18
Var2: 18
Var3: 0.0

(4 marks)

b) What is the output of the following code?

```
result = 13 % 2 ** 4 * 3 // 5 / 2 - 1
print("Result:", result)
```

Result: **2.5**

(3 marks)

c) What is the smallest possible number and what is the largest possible number which can be printed by the following code?

```
import math
import random
var1 = math.pow(2, 5)
var2 = random.randrange(1, 40, 2)
var3 = round(19.689, 2)
var4 = random.randrange(2, 21, 3)
print(min(max(var1, var2), max(var3, var4)))
```

Smallest: **19.69**   Largest: **20**

(4 marks)

d) If a sphere has a radius r, then its volume is given by:

$$V = \frac{4}{3}\pi r^3$$

Complete the following program that calculates the volume of a sphere to 3 decimal places. The program first prompts the user to enter an integer value for the radius. You can assume that the user always enter positive integer values. For example, the program will produce the following output when the user enters 13 for the radius:

```
Radius: 13
The volume of the sphere is 9202.772
```

```
import math
radius = int(input("Radius: "))
volume = 4 / 3 * math.pi * math.pow(radius,3)
volume = round(volume, 3)
print("The volume of the sphere is",volume)
```

(6 marks)

e) Complete the following program so that it calculates the sum of two lengths of time specified in minutes and seconds. The resulting total length of time is printed in hours, minutes and seconds. For example, if the first length of time is 36 minutes and 25 seconds and the second length of time is 57 minutes and 51 seconds, the program will produce the following output:

```
Total time - 1h, 34m, 16s
```

Please note that your program must work for **any two lengths of time** expressed in minutes and seconds.

```
minutes1 = 36
seconds1 = 25
minutes2 = 57
seconds2 = 51
total_seconds = (time_seconds1 + time_seconds2) % 60
carryover_minutes = (time_seconds1 + time_seconds2) // 60
total_minutes = (time_minutes1 + time_minutes2 + \
                 carryover_minutes) % 60
carryover_hours = (time_minutes1 + time_minutes2 + \
                   carryover_minutes) // 60
print("Total time -",carryover_hours,"hour(s)",\
      total_minutes,"minute(s)",total_seconds,"second(s)")
```

(8 marks)

Question 2 (25 marks)

a) What is the output of the following code?

```
print("Easy", "Peasy", sep = "! ", end = "!\n")
print("\\_(^","^)_/", sep = ".")
```

```
Easy! Peasy!
\_(^.^)_/
```

(2 marks)

b) What is the output of the following code?

```
text1 = "QUESTION"
text2 = "2b"
print("*" * (len(text1) + 2))
print(" ", text1.lower(), sep = "")
print(" " * ((len(text1) + 1) // 2), text2.upper(), sep = "")
print("*" * (len(text1) + 2))
```

```
**********
 question
     2B
**********
```

(3 marks)

c) What is the output of the following code?

```
text = "Grey Lynn food truck"
substring = text[0] + text[-9:-5] + text[text.find(" ") + 1] + \
            text[text.rfind(" ") + 3:]
print(substring)
```

```
Good Luck
```

(3 marks)

d) Complete the following program so that it asks the user to enter a sentence. You can assume that the user will always enter a sentence with three words, each separated by a **single space**. All words will be in lowercase and there will be no punctuation. The program will print out a new sentence with the three user words in reverse order. For example, the program executes in the following way when the user has entered the sentence **happy test day** is shown below.

```
Enter a three word sentence: happy test day
New sentence: day test happy
```

```
prompt = "Enter a three word sentence: "
sentence = input(prompt)
space1 = sentence.find(" ")
space2 = sentence.rfind(" ")
word1 = sentence[:space1]
word2 = sentence[space1 + 1:space2]
word3 = sentence[space2 + 1:]
print("New sentence:",word3,word2,word1)
```

(7 marks)

e) Complete the following program so that it prompts the user to enter their name. You can assume that the user will always enter a single name using only alphabetical characters. Your program will select a letter within the name at a random index and substitute it with the next character in the alphabet. The program will then display the new name, all in **lowercase**. Two examples where the user, when prompted, has entered **Damir** and **Azhar** respectively, are shown below:

```
Enter your name: Damir            Enter your name: Azhar
New name: eamir                   New name: aahar
```

```
import random
alphabet = "abcdefghijklmnopqrstuvwxyz"
prompt = "Enter your name: "
name = input(prompt).lower()

random_index = random.randrange(0,len(name))

random_char = name[random_index]

alphabet_pos = alphabet.find(random_char)

new_char = alphabet[(alphabet_pos + 1) % len(alphabet)]

new_name = name[:random_index] + new_char \
           + name[random_index + 1:]

print("New name:",new_name)
```

(10 marks)

Question 3 (25 marks)

a) What is the output of the following code?

```
def display_intro(name, message = "Good morning!"):
    message = "Hello " + name + '. ' + message
    print(message)

def display_text(message):
    print("The output is ", end="")

def main():
    message = "How do you do?"
    display_intro("there")
    print(display_text(message))
    print(message)

main()
```

```
Hello there. Good morning!
The output is None
How do you do?
```

(4 marks)

b) What is the output of the following code?

```
def cost_of_packaging(boxes):
    first_6 = min(boxes, 6)
    above_6 = boxes - 6
    above_6 = max(above_6, 0)
    cost = first_6 * 8 + above_6 * 5
    return cost

def required_boxes(number_items, items_per_box):
    required_boxes = number_items // items_per_box
    left_over_items = number_items % items_per_box
    box_for_left_overs = min(left_over_items, 1)
    required_boxes = required_boxes + box_for_left_overs
    return required_boxes

def display_costs(items, boxes, packaging_cost):
    print("Items:", items)
    print("Boxes needed:", boxes)
    print("Cost: $" + str(packaging_cost))
```

```
def main():
    items_per_box = 5
    items = 57
    boxes_needed = required_boxes(items, items_per_box)
    packaging_costs = cost_of_packaging(boxes_needed)
    display_costs(items, boxes_needed, packaging_costs)

main()
```

```
Items: 57
Boxes needed: 12
Cost: $78
```

(6 marks)

c) Define the function `get_middle()`, which is passed three integer numbers and returns the middle value of the three numbers. For example the call to `get_middle(11, 5, 27)` would return 11. Please note that you are **NOT** allowed to use if statements in this answer.

```
def get_middle(n1, n2, n3):

    sum = n1 + n2 + n3

    minimum = min(n1, n2, n3)

    maximum = max(n1, n2, n3)

    return sum - minimum - maximum
```

(7 marks)

d) Using the code tracing technique taught in lectures, complete the code trace of the following program and provide the output.

```
def first(a):
    b = 3
    print("1.",  a)
    return second(a * b) + b

def second(b):
    print("2.", b)
    return third(b % 4) - 1

def third(c):
    print("3.", c)
    return c * 2 + 2

def main():
    a = 5
    b = first(a)
    print("4.",  b)

main()
```

Output	third()	
1. 5	**c: 3**	8
2. 15		
3. 3	**second()**	
4. 10	**b: 15**	7
	first()	
	a: 5	10
	b: 3	
	main()	
	a: 5	
	b: 10	

(8 marks)

Question 4 (25 marks)

a) What is the output of the following code?

```
def show_output(number):
    if number >= 80 and number < 90:
        print("A")
        number = number - 10
    else:
        print("B")
        number = number + 10
    if number % 7 == 0:
        print("C")
        number = number - 10
    else:
        print("D")
        number = number + 10
    print(number)

def main():
    show_output(74)

main()
```

```
B
C
74
```

(5 marks)

b) Re-define the `get_middle()` function from Question 3(c) using if/elif/else statements. Remember that the `get_middle()` function is passed three integer parameters and returns the middle value of the three numbers.

```
def get_middle(n1,n2,n3):
    if n1 >= n2:
        if n3 >= n1:
            return n1
        elif n2>=n3:
            return n2
        else:
            return n3
    else:
        if n3>=n2:
            return n2
        elif n1>=n3:
            return n1
        else:
            return n3
```

(7 marks)

c) A factor is a number that divides into another number exactly, without leaving a remainder. Complete the function, `print_factors()`, which is passed a single integer parameter. The function prints out all the factors of the parameter on a single line, each separated by a `","`. For example, `print_factors(28)` prints:

```
1, 2, 4, 7, 14, 28.
```

You must use a `while` loop in your implementation.

```python
def print_factors(number):
```

```python
factor = 1
while factor <= number // 2:
    if number % factor == 0:
        print(str(factor) + ", ", end="")
    factor += 1
print(str(number))
```

(8 marks)

d) What is the output of the following code?

```python
def show_number(val1, val2, val3):
    if val1 >= 12 or val2 < 30:
        if val3 > 40 or val2 > val1 and val1 < val3:
            print("A ")
        else:
            if not (val2 > 8 or val3 == 24):
                print("B ")
            else:
                print("C ")
    else:
        print("D ")

def main():
    show_number(24, 11, 33)

main()
```

C

(5 marks)

– Overflow Sheet 1–
Write the question number and letter next to your answer. You must ALSO indicate in the allotted space that you have used the overflow sheet.

– Overflow Sheet 2–
Write the question number and letter next to your answer. You must ALSO
indicate in the allotted space that you have used the overflow sheet.

– Overflow Sheet 3–
Write the question number and letter next to your answer. You must ALSO
indicate in the allotted space that you have used the overflow sheet.

ROUGH WORKING (WILL NOT BE MARKED)
(You may detach this page from the answer booklet and use it for rough working)

ROUGH WORKING (WILL NOT BE MARKED)
(You may detach this page from the answer booklet and use it for rough working)