

**UNIVERSITY OF TORONTO**  
**FACULTY OF APPLIED SCIENCE AND ENGINEERING**  
**ESC180 FINAL EXAM (Part I)**  
Examiners: Saima Ali and Samer Henry

- This is a closed book examination. No aids (calculators, textbooks, notes) are allowed.
- Marks will be awarded for correctness of your code, syntax, comments, docstrings (when required) and the clarity of your program.

Question	Marks
1	4
4	5
6	5
7	4
9	4
10	6
<b>Total</b>	28

### Question 1 [4 marks]

(a) What will this code print? Write your answer in the box. [2 marks]

```
laptops = ["Surface", "Macbook", "Dell"]  
brands = laptops  
ultrabooks = brands[::]  
ultrabooks[1]="Macbook Air"  
  
print(laptops[1] + "and" + brands[1])
```

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(b) What will this code print? Write your answer in the box. [2 marks]

```
def unknown(n):  
    if n < 10:  
        print(n)  
    else:  
        print(n)  
        unknown(n%8)  
        print(n)  
  
unknown(81)
```

## Question 4 [5 marks]

Write a function that, given an integer input between 20 and 99, **prints** its english words without using any loops nor if statements. You do **not** need to check if the number is less than 20 and greater than 99. Include a complete docstring. Please ensure the first letter in each word is capitalized.

Example:

```
>>>read_number(34)
Thirty Four
```

```
def read_number(num):
```

## Question 6 [5 marks]

Examine the following recursive function:

```
def make_list(n):  
    (int) -> List  
    if n == 0:  
        return [0]  
    else:  
        return [make_list(n-1)] + [n]
```

Sample inputs and outputs for the function are shown below:

```
>>> make_list(0)  
[0]  
>>> make_list(1)  
[[0], 1]  
>>> make_list(3)  
[[[0], 1], 2], 3]
```

(a) **Indicate the result of the statement below.** [2 mark]

```
>>> make_list(5)
```

(b) **Create a non-recursive implementation of `make_list()`.** [3 marks]

```
def my_make_list(n):
```

## Question 7 [4 marks]

Examine the following sorting algorithm.

```
from random import shuffle

def is_sorted(l):
    """
    (List[int]) -> bool
    """
    for i in range(len(l)-1):
        if l[i] > l[i+1]:
            return False
    return True

def some_sort(l):
    """
    (List[int]) -> None
    """
    while not is_sorted(l):
        shuffle(l)
        print(l)
```

```
>>> help(shuffle)
Help on method shuffle in module random:

shuffle(x) method of random.Random instance
    Shuffle list x in place, and return None.
```

Fill out the table below when the input to `some_sort()` has a length of 4.

Function	Case	Example input	Maximum number of times <u>underlined</u> statement runs
<code>some_sort()</code>	Best-case		
	Worst-case		

## Question 9 [4 marks]

Penelope is trying to submit her labn.py:

```
[penelope@remote Labn]$ vim labn.py
[penelope@remote Labn]$ python3 labn.py
hello world
goodbye
[penelope@remote Labn]$ git log
commit 220e355a9f19d2b4f109c7ac937eefd9802c42a7
Author: Penelope <penelope@remote.ecf.utoronto.ca>
Date:   Wed Oct 17:51:22 2019 -0400

    added file

[penelope@remote Labn]$ git status
# On branch master
# Changed but not updated:
#   (use "git add <file>..." to update what will be committed)
#   (use "git checkout -- <file>..." to discard changes in working directory)
#
#       modified:   labn.py
#
no changes added to commit (use "git add" and/or "git commit -a")
[penelope@remote Labn]$ git commit
# On branch master
# Changed but not updated:
#   (use "git add <file>..." to update what will be committed)
#   (use "git checkout -- <file>..." to discard changes in working directory)
#
#       modified:   labn.py
#
no changes added to commit (use "git add" and/or "git commit -a")
[penelope@remote Labn]$ git push
Everything up-to-date
[penelope@remote Labn]$
```

(a) It is currently 7:30 pm on Wednesday, October 9<sup>th</sup> and Penelope has been working on her code for about an hour and a half. Has the file successfully been pushed to the marking server? **Circle one [1 mark]:**

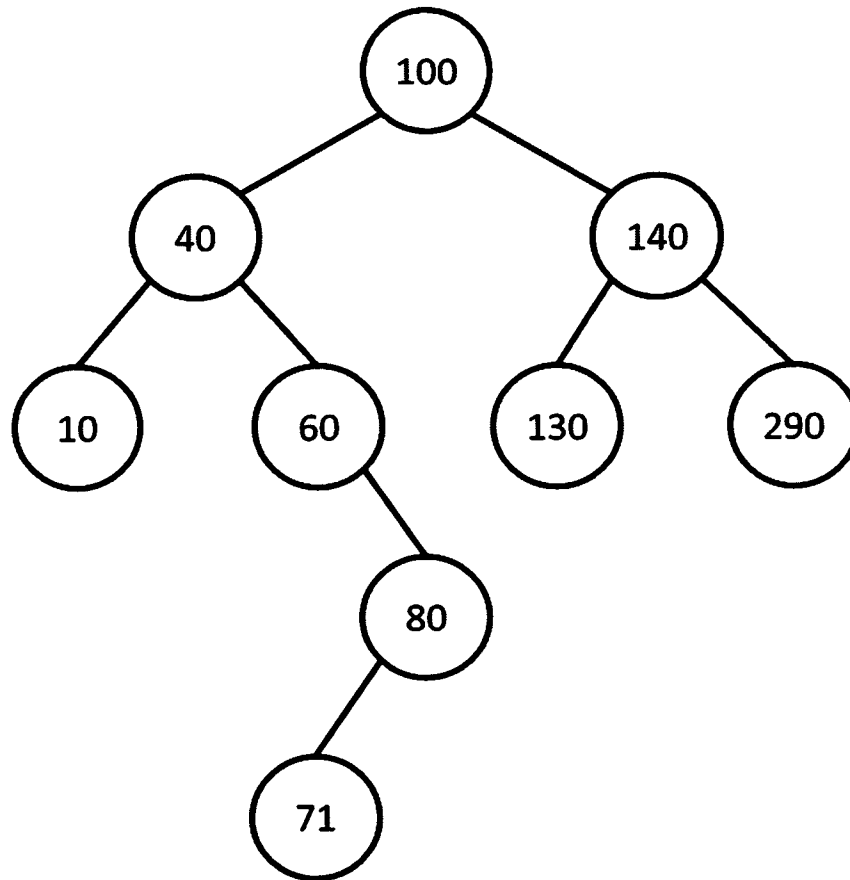
[YES]

[NO]

(b) **Circle 1 or 2 indications in the above image that explain whether the code has been successfully submitted. Explain your reasoning in 1-2 sentences. [3 marks]**

### Question 10 [6 marks]

(a) Given the following Binary Search Tree, **draw onto the figure the result of inserting the node with value 77 to the tree.** [1 mark]



(b) **What is the height** of the resulting tree in part (a)? [1 mark]

(c) Draw a minimal height (i.e. balanced) binary search tree **using all of the values** from the resulting tree from part (a). [3 marks]

(d) What is the height of the minimal height (balanced) tree? [1 marks]



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