UNIVERSITY OF ESWATINI

FACULTY OF SCIENCE & ENGINEERING

DEPARTMENT OF ELECTRICAL & ELECTRONIC ENGINEERING

MAIN EXAMINATION

NOVEMBER 2019

TITLE OF PAPER: PROGRAMMING TECHNIQUES I

COURSE CODE: EEE271

DURATION: 3 HOURS

INSTRUCTIONS:

1. There are five (5) questions in this paper. Answer question 1 and any other three (3) questions.
2. Each question carries equal marks.
3. Use correct notation and show all your steps clearly in any program analysis.
4. All programs should be sufficiently commented and indented for clarity.
5. Start each question in a new page.

This paper should not be opened until permission has been given by the invigilator.

This paper contains six (6) pages including this page.

Question 1 [25 Marks]

a. Explain the difference between an if-else and switch statement. [2]

b. Give 2 examples of selection control statements. For each example, with the aid of a flow chart explain the general syntax. [8]

c. What is a recursive function? What is a base case? [3]

d. Discuss the meaning of the following terms: [6]
  i. Loading
  ii. Linking
  iii. Execution

e. Explain the following concepts:
  i. Call by value. [3]
  ii. Call by reference. [3]

Question 2 [25 Marks]

a. Assume a = 3, b = 6, c = 8 and d = 9. What does the following statement print? [2]

```
printf ("%d\n%d\n%d", a != 1 && d <= 9, b == 1 || c <= 15,c%3);
```

b. What are the values stored in array **a** after the program segment shown in figure 1 has been executed. [3]

```
int a[9] = {0, 1, 2, 3, 4, 5, 6, 7, 8};
for (i = 0; i < 6; i = i + 2)
     a[i+2] = a[i];
```

c. What is the output after the program segment shown below has been executed. [3]

```
int p_test (int a, int * b) {
  int d;
  d = a - *b;
  a = d;
 *b = d:
  return d;
}
int main (void) {
  int a=1, b=2, c=3, d=4;
  c = p_test (a, &b);
  printf ("%d %d %d %d", a, b, c, d);
  ...
```

d. Given the program fragment shown in Figure 2Q.d, do the following;
  i. Briefly explain what the program does and show the output produced. [4]

ii. Rewrite the program segment to produce the following output   [8]

```
******
*****
***
*
```

```
1 #define SIZE 4
...
2 int col;
3 int row = 1;
4 while (row <= SIZE) {
5    col = 1;
6    while (col <= row){
7       printf("*");
8       col = col + 1;
}
10   printf("\n");
11   row = row + 1;
}
...
```

Figure Q.2d

e. Identify and explain 10 syntax errors from the C program shown in Figure Q.2e. For each error specify the line at which it has been identified.   [5]

Example:
Line 4: Missing semicolon at the end of statement. Every program statement must be terminated with a semicolon

```
#include <stdio.h>

int number1
int Main(void)
     int 2s == 3;
     Printf("\nEnter number:);
     Scanf("%i", &2s)
     Printf("The Number is: %i", number);
     return "executed successfully";
}
```

Figure Q.2e

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Question 3 [25 Marks]

a. Write a function *multiple* that determines for a pair of integers whether the second integer is a multiple of the first. The function should take two integer arguments and return 1 if the second is a multiple of the first, 0 otherwise.

[7]

b. Write a function *reverse* that takes as its arguments the following:
   (1) an array of floating point values;
   (2) an integer that tells how many floating point values are in the array.

The function must reverse the order of the values in the array. For instance, if the array passed to the function is:

0	1	2	3	4
5.8	2.6	9.0	3.4	7.1

Then when the function returns, the array will have been modified so that it is:

0	1	2	3	4
7.1	3.4	9.0	2.6	5.8

The function should not return any value.

[10]

c. Write a recursive function *intPower* that takes two integers, the base and exponent as arguments and returns an integer,

$$base^{exponent}.$$

For example, *intPower(3,3)* = 3*3*3 = 27.

[8]

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Question 4 [25 Marks]

a. Write a function that uses the binary search algorithm to find a key from a one dimensional array that stores N integers. If the key is not found the program should return -1 as a flag. [10]

b. Write a program to store an input list of five numbers in an array named list and display the largest element in the array using a function named get_max. The function get_max will use the array and its size as input parameters and then returns the largest element in the array. [15]

Sample output

```
Enter five numbers: 34 100 89 2 4
Element in array list[0] = 34
Element in array list[1] = 100
Element in array list[2] = 89
Element in array list[3] = 2
Element in array list[4] = 4
Largest element in array list: 100
```
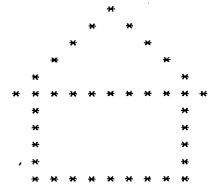
Question 5 [25 Marks]

Using repetition statements, write a program that displays the following checkerboard pattern. Your program must use a combination of the following output statements:

```
printf("* ");

printf("*");

printf(" ");

printf("\n");
```

Your program will be graded according to the following criteria:

i.   Correctness – does the program produce the desired result.   [18]
ii.   Clarity – proper indentation of program makes it easy to read.   [3]
iii. Sensible naming of variables – for documentation and debugging purposes [2]
iv.   Proper use of comments – also make the program easy to read.   [2]

End of Paper