ESC 101: Fundamentals of Computing				**Major Quiz II** (31 Oct 2018)			
Name	**ANSWER KEY**					**50 marks** Page **1** of **6**	**B**
Roll No		Dept.		Section			

Instructions:
1. This question paper contains 3 pages (6 sides of paper). Please verify.
2. Write your name, roll number, department and section **on every sheet** of this booklet.
3. Write your final answers neatly **with a blue/black pen**. Pencil marks may get smudged.

Q1. Write **T** or **F** for True/False (write **only in the box on the right hand side**) (**10x1=10marks**)

1	The size of a pointer to a pointer to a character variable is always 8 bytes.	**T**
2	Let `char b[20];` be a character array such that the first NULL character in the array is located at index 0. Then `strlen(b)` will return the value 1.	**F**
3	Functions with input type `void` cannot take inputs.	**T**
4	The statement `long *a = (int*)malloc(8);` will allocate enough space for a single long variable to be stored. (we will get a warning for incompatible pointer type but space will get allocated normally and we can use `a` as usual too)	**T**
5	If `char a = 42;` is a char variable and `char *ptr = &a;` is a pointer to `a`. Then the expression `&(&(a));` gives the address where pointer `ptr` is stored.	**F**
6	If a function in C has return type `void`, it means it can choose to return anything it likes, sometimes a pointer, sometimes a long, and sometimes an int.	**F**
7	After using `malloc` to dynamically create an array, I must free that memory using `free` before using `malloc` again otherwise it will always result in a segfault	**F**
8	Let `char str[100];` be a character array storing a string. Then the array `str` is not allowed to contain more than one NULL character.	**F**
9	The return type of a C function must be the same as the type of one of the inputs to the function	**F**
10	Let `int *a = (int*)malloc(32);` be a dynamic array of 8 integers. If we write `a++;` now `a` will start pointing to the second element of the array.	**T**

Q2. Fill the circle (**don't tick**) next to the correct option (**only one choice correct**).(**5x2=10marks**)

2.1 We have a static 2D matrix `int A[5][3];` and let `int *ptr = &A[0][0];` Two claims are being made about this array.

Claim 1: `*(ptr+i+j)` gives value of `A[i][j]`

Claim 2: `*(ptr+3*i+j)` gives value of `A[i][j]`

A	Claim 1 is TRUE, claim 2 is FALSE	○
B	Claim 1 is FALSE, claim 2 is TRUE	●
C	Both claims are TRUE	○
D	Both claims are FALSE	○

2.2 What will be the output of the following program?

```
#include <stdio.h>
float f(int a) { return (float)a*a; }
int main(){
    float a = 1.5;
    printf("%0.2f", f(a));
    return 0;
}
```

A	2.25	○
B	1.00	●
C	2	○
D	1	○

2.3 What value will this function return? Assume `string.h` has been included.

```
int foo(){
    char A[] = "HI\nHELLOHOWAREYOU";
    char *B = A;
    return strlen(B + 2);
}
```

A	17
B	0
C	15
D	1

2.4 What will be the output when we try to execute the program given on the right?

A	Compilation/runtime error
B	Ring a Roses
C	Ring a Ring o Roses
D	Ring o Roses

```
#include <stdio.h>
void foo(){ printf("Ring a ");
return; printf("Ring o ");  }
int main(){
    foo();
    printf("Roses");
    return 0;
}
```

2.5 What will be the output when we try to execute the program given on the right?

A	10 20
B	40 20
C	Compilation error
D	4 2

```
#include <stdio.h>
int main(){
    int a = 32;
    printf("%o %X", a, a);
    return 0;
}
```

Q3. Fill in the circles next to ALL CORRECT options (**many may be correct**). (**3x3=9marks**)

3.1 Suppose we have `float a = 2.5; float *b = &a;` Which all of the following statements will print the number 2 on the output? Assume that these statements are executed inside `main()` in separate programs and that `stdio.h` has been included.

A	`printf("%ld", (b + 2) - b);`
B	`printf("%d", **b);`
C	`printf("%d", (int)'4' - 2);`
D	`printf("%d", (int)*(&a));`

3.2 Suppose `char P[] = "RIDDIKULUS"; char Q[] = "WINGARDIUM\0LEVIOSA";` Which of these statements generate the output given on the right? Assume that the statements are executed separately and that `stdio.h` has been included.

A	`printf("%s",P);`	RIDDIKULUS
B	`printf("%s",Q+11);`	LEVIOSA
C	`printf("%c",(int)('M'+3.5));`	SegFault
D	`printf("%c",(char)('f'));`	f

3.3 Which of these statements generate the output given on the right? Assume that the statements are executed separately and that `stdio.h` has been included.

A	`printf("%d",*(&(12)));`	12
B	`printf("%x",30);`	1e
C	`printf("%0.3f",(1.2));`	1.2
D	`printf("%x",'Z' - 'A');`	19

Q4 In the space provided, write down the output of the program when given the input indicated. Getting every line of output correctly carries equal weightage. (**2+4=6marks**)

4.1 Write down the output for the given input in the space provided. The output has two lines. Assume that `stdio.h` has been included.

OUTPUT
5 5
1 5

```
void process(int *p, int *q){
    p = q;
    *p = 5;
    printf("%d %d\n", *p, *q);
}
int main(){
    int a = 1, b = 2;
    process(&a, &b);
    printf("%d %d", a, b);

    return 0;
}
```

4.2 Write down the output for the given input in the space provided. The output has four lines. Assume that `stdio.h` and `stdlib.h` have been included. Note that in the first three lines, there is a single space between the integers. In order to indicate a space in your answer, leave a small gap (**don't write a dot like Prutor**).

OUTPUT
5 5 6
5 6 6
5 6 5
150

```
int main(){
  int **a = (int**)malloc(8);
  *a = (int*)malloc(sizeof(int));
  **a = 4;

  int **b = (int**)malloc(8);
  *b = (int*)malloc(sizeof(int));
  **b = 5;

  int **c = (int**)malloc(8);
  *c = (int*)malloc(sizeof(int));
  **c = 6;

  *a = *b;
  printf("%d %d %d\n",**a,**b,**c);
  *b = *c;
  printf("%d %d %d\n",**a,**b,**c);
  *c = *a;
  printf("%d %d %d\n",**a,**b,**c);
  printf("%d", (**a)*(**b)*(**c));

  return 0;

}
```

Q5 In the following questions, you will be given incomplete code. Fill in the blanks neatly with code so that the program ends up doing what is specified in the question. If you need to indicate a space, leave a small gap (**don't write a dot like Prutor**). (**5+1=6marks**)

5.1 The following program is supposed to create three n x n matrices named A, B and C such that all entries of all three matrices are initialized to zero. Then, the entries of the first two

matrices A and B are read from the input and the product of the two matrices is to be computed and stored in the matrix C. Assume that **`stdio.h`** and **`stdlib.h`** have been included.

```
int main(){
    int n, i, j, k;
    scanf("%d", &n);
    int** a = (int**)calloc(n, sizeof(int*));
    int** b = (int**)calloc(n, sizeof(int*));
    int** c = (int**)calloc(n, sizeof(int*));
    for(i = 0; i < n; i++){
     a[i] = (int*)calloc(n, sizeof(int));
     b[i] = (int*)calloc(n, sizeof(int));
     c[i] = (int*)calloc(n, sizeof(int));
    }
    for(i = 0; i < n; i++)
         for (j = 0; j < n; j++)
              scanf("%d %d", &(a[i][j]), &(b[i][j]));
    for(i = 0; i < n; i++){
      for(j = 0; j < n; j++){
        for(k = 0; k < n; k++){
          c[i][j] += a[i][k] * b[k][j];
        }
      }
    }
    return 0;
}
```

5.2 The following function is supposed to return the length of the string given as input. Assume that the character array given as input contains at least one NULL character.

```
int strlength(char* A){
    int ans = 0, i = 0;
    while(A[i] != '\0'){
        ans++;
        i++;
    }
    return ans;
}
```

Q6 In the following questions, you are given incorrect code. Correct the code by pointing out the line numbers that require correction, as well as write down the corrected line. Point out and correct all types of errors (compilation, runtime, logical). Frivolous and unnecessary corrections may receive negative marks. (**4+5=9marks**)

6.1 The following program was meant to compute the binomial coefficient recursively. Correct it so that it works for all positive numbers n and k (assume all inputs n and k will be small enough so that integer overflow will not be an issue i.e. assume that the final output and all intermediate computations will fit inside int variables). The recursive definition of the binomial coefficient is

Binom(n, k) = Binom(n - 1, k) + Binom(n-1, k-1);

```
 1 #include <stdio.h>
 2 int binom(int n, int k){
 3     if(n < k)
 4         return 0;
 5     return binom(n--, k) + binom(n--, k--);
 6 }
 7 int main(){
 8     int n, k;
 9     scanf("%d %d", &n, &k); // Assume n >= k in the input
10     printf("%d", binom(int n, int k));
11     return 0;
12 }
```

Line No	Corrected Code
3	`if(k == 0 || n == k)`
4	`return 1;`
5	`return binom(n - 1, k) + binom(n - 1, k - 1);`
10	`printf("%d", binom(n, k));`

DO NOT SUGGEST CORRECTIONS TO MORE THAN 6 LINES

6.2 The function minimax in following program was meant to take 4 inputs, the values of two integers, and two pointers to the original integers storing those values. Say the integers being passed to the function are a and b. Then the function minimax was supposed to check if a is strictly smaller than b, and if so, swap the original variables.

```
 1 #include <stdio.h>
 2 void minmax(int a, int b, int* pa, int* pb){
 3     if(a < b){
 4         int *var = pa;
 5         pa = pb;
 6         pb = var;
 7     }
 8     return 0;
 9 }
10 int main(){
11     int a, b;
12     scanf("%d %d", *a, *b);
13     minmax(a, b, &a, &b);
14     return 0;
15 }
```

Line No	Corrected Code
4	`int var = *pa;`
5	`*pa = *pb;`
6	`*pb = var;`
8	`return;`
12	`scanf("%d %d", &a, &b);`

DO NOT SUGGEST CORRECTIONS TO MORE THAN 7 LINES

---------- END OF QUIZ ----------

SPACE FOR ROUGH WORK