ESC 101: Fundamentals of Computing **Major Quiz 2** Date: 01 – 04 - 2019

Name						**B**
Roll No.		Dept.		Section		

Total 55 Marks

Instructions:

1. This question paper contains a total of **4** pages (**7** printed side of paper).
2. Write your roll number on every sheet of this booklet.
3. Write final answers neatly with a blue/black pen in the given boxes.
4. **Answers written outside the box will NOT be graded.**

Q. 1. Write TRUE or FALSE against the given statements **(1 x 10 = 10 Marks)**

1	If we allocate a memory of 100 bytes using a single malloc call, we can free 50 bytes from this block using free().	FALSE
2	Size of a union variable is equal to max of all the sizes of constituent variable in the union.	TRUE
3	When a structure is passed as an argument to a function, it is passed by value.	TRUE
4	When an array is passed as an argument to a function, it is passed by value.	FALSE
5	Let int a[10] be an array, then the pointer b, initialized as, int *b = (*a+1) will point to a[1].	FALSE
6	Malloc returns a pointer to a memory location which is of the type NULL.	FALSE
7	Size of int pointer is same as char pointer.	TRUE
8	A 2D array (int a[10][10]) may or maynot have a contiguous block of (10*10*sizeof(int)) bytes in the memory.	FALSE
9	We can use free to release memory of a statically declared array. (For eg. int a[10]; free(a);).	FALSE
10	A segmentation fault refers to a situation when your program tries to access/modify memory location not allocated to it.	TRUE

Q. 2. Multiple Choice Question (Single Correct Only) **(2 x 5 = 10 Marks)**

1. During memory allocation, automatic memory allocation and dynamic memory allocation respectively use

A) Stack and Heap [●]
B) Heap and Stack [ ]
C) Heap and Heap [ ]
D) Stack and Stack [ ]

2. The function realloc() can be used on which of the following types of memory

A) statically allocated memory [ ]
B) dynamically allocated memory [●]
C) automatically allocated memory [ ]
D) both (b) & (c) [ ]

3. Which of the following can cause segmentation faults

A) dereferencing a dangling pointer [●]
B) typecasting a dangling pointer [ ]
C) modifying the value of a dangling pointer [ ]
D) All of the above [ ]

4. Linked lists are SLOWER than arrays for which of the following operations. Assume that only the head of the linked list and the name of the array are given.

A) inserting an element (pointer to the node after which insertion is to be done is given) [ ]
B) searching for an element [ ]
C) modifying an element given its position from the start/head [●]
D) all of the above [ ]

5. Which of the following statements is correct?

A) all pointer types with an associated memory block can be dereferenced [ ]
B) having a return statement in a void function can cause compilation error [●]
C) malloc() returns a integer pointer to the memory area alloted which may not have all its values assigned zero [ ]
D) none of the above [ ]

Q. 3. Multiple Choice Question (Multiple Correct) (3 x 5 = 15 Marks)

1. Consider the following 2 Dimensional array int a[20][20]; Choose all the option(s) which is equivalent to a[5][10].

A) (*(a[5]) + 10) [ ]
B) *((a + 5) + 10) [ ]
C) (*(a + 5))[10] [●]
D) *(*a + 5*20 + 10) [●]
E) *(*(a + 5) + 10) [●]

2. Consider the following structure and the following two instantiations.

```
struct student {
      char *name;
      int class;
      int roll_number;
}
```

Instantiations:

```
struct student *s = (struct sudent*) malloc(sizeof(student));
struct student t;
```

Choose the correct option(s) w.r.t. above instantiations of struct student.

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A) s will point to a memory block of size = 2*sizeof(int) + sizeof(char*). [●]
B) s->roll_number will access the roll_number field of the student structure instantiation s. [●]
C) t->roll_number will access the roll_number field of the student structure instantiation t. [ ]
D) s.name will access the name field of the student structure instantiation s. [ ]
E) t.name will access the name field of the student structure instantiation t. [●]

3. Consider the following string: char a[100] = "THE ANSWER IS\0 42"; Choose all the correct option(s):

A) strlen(a) is equal to 14. [ ]
B) printf("%s", (char*)(a + (int)4.2)); will print: ANSWER IS [●]
C) After strcat(a, a), printing a will print THE ANSWER IS THE ANSWER IS [ ]
D) Memory used by array a is equal to 100*sizeof(char) [●]
E) printing a[100] may give segmentation fault. [●]

4. Consider a singly linked list with 10 elements. Where each node is designed as follows.

```
struct node {
        struct node *next;
        int value;
}
```

Choose the correct option(s) with respect to above linked list. Assume that we DON'T have the head pointer, unless stated otherwise.

A) If we have a pointer to 5th element, we can delete 4th element. [ ]
B) If we have a pointer to 4th element, we can delete 5th element. [●]
C) If we have head pointer, head->next->value will be equal to value of the second element. [●]
D) If we have head pointer, size of the head pointer will be equal to sizeof(int*). [●]
E) If we have head pointer, head + 1 will point to the second element of the list. [ ]

5. Consider the following code snippet. Choose all the correct option(s).

```
int main() {
      int a = 10, b = 20;
      int *pa = &a, *pb = &b;
      int **ppa = &pa, **ppb = &pb;

      printf("%d\n", (*pa)*(*pb));           // (1)
      ppa = ppb;
      printf("%d\n", (*pa)*(**ppa));         // (2)
      printf("%d\n", (*ppa == *ppb));        // (3)
      *pa = b;
      printf("%d\n", (**ppa != *pa));        // (4)
}
```

A) 100 will be printed at line (1) [ ]
B) 200 will be printed at line (2) [●]
C) 1 will be printed at line (3) [●]
D) 0 will be printed at line (4) [●]
E) None of the above [ ]

Q. 4: Write the output for the following programs. **(5 x 2 = 10 Marks)**

1. MAGIC SQUARE

```c
#include <stdio.h>

void function(int size, int a[][3]){
   int sqr = size * size;
   int i = size-1, j = 1, k;
   for (k = 1; k <=sqr; ++k) {
       a[i][j] = k;
       i++;
       j--;

       if (k % size){
           if (j < 0) j += size;
           if (i == size) i -= size;
       }
       else {
           i -= 2;
           j++;
       }
   }
   for (i = 0; i < size; i++){
       for (j = 0; j < size; j++){
           printf("%d  ", a[i][j]);
       }
       printf("\n");
   }
   printf("\n");
}

int main( ){
   int arr[3][3];
   function(3, arr);
   return 0;
}
```

OUTPUT

```
2 9 4
7 5 3
6 1 8
```

2. RECURSIVE DISPLAY

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```c
#include <stdio.h>
#include <stdlib.h>

typedef struct node{
   int data;
   struct node *next;
}node;

void print1(node * );
void print2(node * );

void insert_new_node (node ** head_ref, int new_data){
   node * new_node = (node *) malloc(sizeof(node));
   new_node -> data = new_data;
   new_node -> next = (*head_ref);
   (*head_ref) = new_node;
}
void print0(node *head){
   if (head == NULL) return;
   printf("%d ", head -> data);
   print0(head -> next);
}
void print1(node *head){
   if (head == NULL) return;
   print2(head -> next);
   printf("%d ", head -> data);
}
void print2(node *head){
   if (head == NULL) return;
   printf("%d ", head -> data);
   print1(head -> next);
}
int main (){
   node *head = NULL;
   insert_new_node (&head, 1);
   insert_new_node (&head, 2);
   insert_new_node (&head, 3);
   insert_new_node (&head, 4);
   print0(head);
   print2(head);
   return 0;
}
```

OUTPUT

```
4 3 2 1 4 2 1 3
```

Q. 4: Fill in the blanks with appropriate code in the following programs. (5 x 2 = 10 Marks)
Assume appropriate includes.

1. Given an area of n x m. You have infinite number of tiles of size 2^i *X* 2^i where i = 0, 1, 2,... so on. The task is to find minimum number of tiles required to fill the given area with tiles.

```
#include<stdio.h>

int minTilesRequired(int n , int m){
    if (n == 0 || m == 0) return 0;
    else if (n%2 == 0 && m%2 == 0)
       return minTilesRequired(____A____, ____B___);
    else if (n%2 == 0 && m%2 == _____C____)
        return (n + minTilesRequired(n/2, m/2));

    else if (n%2 == 1 && m%2 == ____D_____)
        return (m + minTilesRequired(n/2, m/2));

    else
        return (n + m - 1 + minTilesRequired(n/2, m/2));
}

int main()
{
    int n,m;
    scanf("%d%d",&n,&m);
    printf("%d", minTilesRequired(n,m));
    return 0;
}
```

A: **n / 2**

B: **m / 2**

C: **1**

D: **0**

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2. In computer science, a QUEUE is a collection in which the entities in the collection are kept in order and the principal (or only) operations on the collection are the addition of entities to the rear terminal position, known as ENQUEUE, and removal of entities from the front terminal position, known as DEQUEUE. This makes the queue a First-In-First-Out (FIFO) data structure. In a FIFO data structure, the first element added to the queue will be the first one to be removed.

```
typedef struct node{
   int data;
   struct node *next;
}node;

node *front=NULL;
node *rear=NULL;

void enqueue(int value){
   node *tmp = (node*)malloc(sizeof(node));
   tmp->data = value;
   tmp->next = NULL;
   if( rear != NULL ){          //(A)
       rear->next = tmp;
       rear = tmp;   //(B)
   }
   else front = rear = tmp;
}
int dequeue(){
   node *tmp = front;
   int n = front->data;
   front = front->next;
   free( tmp );      //(C)
   return n;
}
void display(node* head){
   if(head == NULL) printf("NULL\n");
   else{
       printf("%d ", head->data);
       display( head->next ); //(D)
   }
}
int main(){
   enqueue(10); enqueue(20); enqueue(30);
   display(front); dequeue(); display(front);
}
```