National University of Computer and Emerging Sciences

FAST School of Computing **Spring-2022** **Islamabad Campus**

Question 1 [30 Marks]

Part-A: What will be the output of the given programs? In case of an error(s), circle that part in the code and mention the reason for that error(s) in one line [2 x 9 = 18 marks]
Assume code is written inside the main function for all 9 parts of this question.

1	int my_var = 15;
	int my_var2 = 20;
	
	int* my_var_ptr = &my_var;
	int* my_ptr = my_var_ptr;
	my_var_ptr = my_var2;
	
	cout << *my_var_ptr;
		20 X

2	double a = 12.4;
	double* ptr = &a;
	double b = 22.5;
	double* ptr2 = &b;
	*ptr = b;
	
	if (ptr == ptr2)
	  cout << "equal";
	else
	  cout << "not equal";
		equal X

3	bool x = 0;
	int y = 19;
	char z = 's';
	
	int* i = &y;
	char* c = &y;
	void* ptr = &z;
	
	cout << *ptr;
		False X

4	bool x = 0;
	int y = 19;
	int* yy = &y;
	short* z = (short*)yy;
	
	cout << --(*z) << endl;
	cout << ++(*yy);
		19
		20 X

5	char my_array[] = "OOP is so easy!";
	char* my_ptr;
	my_ptr = my_array;
	my_ptr = my_ptr + 13;
	
	cout << *my_ptr;
	cout << *(my_ptr - 3);
	my_ptr--;
	cout << *my_ptr;
		"s"
		" "
		"o"

6	float data[] = { 10.2,20.0, 30.5, 40.5, 76.1};
	
	double * a = new double;
	*a = *(data + 2);
	a++;
	
	*a = (*a - *(a - 1));
	cout << *(data+3);
		10

7	char **s = new char*[2];
	for(int i=0; i<4; i++)
	*(s+i) = new char[2];
	
	((s+1)) = 65; //ASCII for 'A'
	*(*s+1) = 66;
	s[1][1] = 67;
	**s = 68;
	
	for(int j=0; j<2; j++)
	{
	for(int k=0; k<2; k++){
	cout<< s[j][k]<<" ";
	}
	cout<<endl;
	}
		D B C B

8	int var1 = 170;
	int *p= &var1;
	const int* ptr = p;
	
	cout<< *p <<" "<< *ptr <<endl;
	cout<< (*p)++ <<" "<< ++(*ptr);
		ptr is a constant pointer, can't be incremented

9	const int x = 11;
	const int *const ptr = &x;
	int y = 15;
	const int *p = &x;
	int * const ptr2 = &y;
	ptr2 = p;
	cout<<*p<<" "<<*ptr<<" "<<*ptr2;
		ptr2 is a constant pointer, cannot be reassigned

Part-B: Rewrite the given code using dynamic 2D arrays. Only use deference operator (*) to access or modify array elements (don't use array subscript notations e.g. arr[i][j]). [5 marks]

```
int func(int arr[][3],int r, int c){

   int sum=0;
   for(int i=0; i<r; i++)
   {
      for(int j=0; j<c; j++){

         if(i == j)
           sum += arr[i][j];
      }
   }
   return sum;
}

int main()
{
   int row=3, col=3;
   int a[][3] = {1,2,3,4,5,6,7,8,9};
   cout<<func(a, row, col)<<endl;

   return 0;
}
```

```
int func(*arr ,int r , int c)
{
   int sum = 0
   for (int i =0 ; i<r ; i++)
   {
      for (int j =0 ; j<c ; j++)
      {
         if (i == j)
           sum += *(*(arr+i)+j);
      }
   }
   return sum;
}

int main()
{
   int row =3, col =3;
   int *a = new int {1,2,3,4,5,6,7,8,9};
   cout << func(a ,row ,col) << endl;
   return(0);
}
```

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Part-C: Write a recursive function called PowerOfFour. Given an integer n, return true if it is a power of four. Otherwise, return false. [7 marks]

An integer n is a power of four, if there exists an integer x such that $n == 4^x$

Example 1: Input: n = 16
Output: true

Example 2: Input: n = 12
Output: *false*

```
PowerOfFour(x, n)
{
    If (n > pow(4,x))
        return false;
    Else if (n == pow(4,x))
        return true;
    PowerOfFour(x+1, n);
}
```

Question 2 [30 Marks]

Part-A: What would be the output produced by executing the following C++ codes? Identify errors, if any (either write output or error, both will not be accepted). All the code snippet contains #include<iostream> and using namespace std;

a. [3 Mark]

```
int main( )
{
   void* vp;
   char ch = 'g';const char *cp = "goofy";
   int j = 20;
   vp = &ch;
   cout << *(char*)vp;
   vp = &j;
   cout << *(int*)vp;
   vp =(void*) cp;
   cout << (char*)vp + 3 << endl;
   return 0;
}
```

04/30

Output/Errors:

g20f

2

b. [8 Mark]

```
const char* c[] = { "Oopsmid-1", "MID", "OOP", "Exam" };
char const * * cp[] = { c + 3, c + 2, c + 1, c };
char const *** cpp = cp;

int main()
{
   cout << **(cpp + 1) << endl;
   cout << *(*(*(cpp + 2) + 2) + 3) << endl;
   cout << *((*cpp) - 2) << endl;
   cout << *(*(cpp + 3) + 0) + 3 << endl;
   return 0;
}
```

Output/Errors:

MID
Exam
Oopsmid-1
Exam

3/8

c. [3 marks]

```
struct IntArray{
  int * arr,size;
  void create(int *ptr,int s){
     size=s;
     arr=ptr;
  }
  void display(){
     for(int i=0;i<size;i++)
        cout<<arr[i]<<" ";
        cout<<endl;
  }
};
int main(){
    int arr[]={4,0,3,1,2};
     IntArray my_arr;
     my_arr.create(arr+2,3);
     arr[my_arr.arr[0]]=arr[arr[1]];
     my_arr.display();
     return 0;
}
```

Output/Errors:

00 312

300

Rough work:

d. [6 Mark]

```
struct structure {
    int x;
    structure *ptr;
};
int main()
{
structure three={10},two={20},one={30},*pointer=&one;
   three.ptr =&two;  one.ptr = &three;
   while(pointer != nullptr)
   {
      cout<<pointer->x<<" -> ";
      pointer=pointer->ptr;
   }
  cout<<"."<<endl;
  return 0;
}
```

Output/Errors:

cout statement error

Rough work

e. [6 marks]

```
struct A {
   int x;
   A(int i=10){x=i;cout<<x<<endl;}
  ~A(){cout<<endl<<x;}
}a;
int main()
{
   A a(20),* b;
   if(a.x == 20){
      A a;
      b=new A(30);
   }
   return 0; }
```

Output/Errors:

f. [4 marks]

```
class integer{
   private:
   int i;
   public:
   integer(int ii){i=ii;}
   int getI(){return i;}
   void setI(int ii){i=ii;}
};
void display(integer i){
   cout<<"integer is "<<i.getI()<<endl;
}
void decrement(integer i){
   i.setI(i.getI()-1);
}
void increment_decrement(integer & i){
   static int s;
   if(s == 0){
      i.setI(i.getI()+1);
      s++;
   }
   else{
      decrement(i);
      s--;
   }
   display(i);
}
int main(){
   integer i(10);
   display(i);
   increment_decrement(i);
   increment_decrement(i);
   increment_decrement(i);
   return 0;
}
```

Output/Errors:

integer is 10
11
10
11