Question Paper - 06

Question No. 01
Declare a structure called Time that will hold three integers hour, minute, and second. Declare a Time variable that holds 6:30 PM. (Think about 24 hour Time Format)
Time নামক একটি structure declare করুন যাতে hour, minute, second তিনটি integer থাকবে। এরপর একটি Time variable declare করে তাতে 6:30 PM রাখুন। (24-hour time format এর ব্যাপারে একটু ভেবে দেখুন)

```
#include <stdio.h>
struct Time{
   int hour;
   int minute;
   int second;
};
int main(){
   int flag=3;
   struct Time time={6,30,00} ;//hour,min,sec

   if(time.hour==12){
     printf("%d:%d PM",time.hour,time.minute);
   }
   else if(time.hour==24){
     time.hour=12;
     printf("%d:%d AM",time.hour,time.minute);
   }
   else if(time.hour>12){
     time.hour=time.hour-12;
      printf("%d:%d",time.hour,time.minute);
      flag=1;
  }
   else if(time.hour<12){
      printf("%d:%d",time.hour,time.minute);
      flag=0;
  }

   if(flag==1)   printf(" PM");
   else if(flag==0)   printf(" AM");
   return 0;
}
```

Question No. 02

Consider the following structure that represents a time interval:

```
struct Interval{
   struct Time start;
   struct Time end;
}
```

Declare an interval that starts at 5:30 and ends at 10:15.

নিচের structureটি সময়ের ব্যবধানকে represent করে

```
struct Interval{
   struct Time start;
   struct Time end;
}
```

এখন আপনাকে একটি সময় ব্যবধান declare করতে হবে যা 5.30 এ start হয় এবং 10.15 এ end হয়।

```
#include <stdio.h>
struct Time{
    int hour;
    int minute;
    int second;
};
struct Interval{
    struct Time start;
    struct Time end;
};
int main()
{
   struct Interval time1={
       .start={05,30,00},
       .end={10,15,00}
   } ;
    printf("%d:%d:%d PM\n",time1.start.hour,time1.start.minute,time1.start.second);
    printf("%d:%d:%d PM",time1.end.hour,time1.end.minute,time1.end.second);
    return 0;
}
```

Question No. 03
Can a struct have a member variable that is an array? Give an example.
Structure এ member variable হিসেবে কি array রাখা যায়? একটি উদাহরণ দিন।

Ans: A structure can have array variable as its element. Below is an example,which gives element wise sum of array elements.
 	
//sum of array elements
#include <stdio.h>
 	
struct arrayHolder{
  int array[100];
};
 	
struct arrayHolder arraySum(int n,int a[],int b[]){
  struct arrayHolder sum;
  for(int i=0; i<n; i++){
  sum.array[i]=a[i]+b[i];
  }
  return sum;
}
 	
int main(){
 	
  int a[100]={1,2,3};
  int b[100]={4,5,6};
 	
  int n=3; //array size
 	
  struct arrayHolder ans;
  ans=arraySum(n,a,b);
 	
  for(int i=0; i<n; i++){
  printf("%d ",ans.array[i]);
  }
}

Question No. 04

Remember the fraction structure that we wrote. Write a function that takes a fraction and returns its inverse. For example, the inverse of 2/3 is 3/2.

মনে আছে fraction(ভগ্নাংশ) structure এর কথা যেটি আমরা লিখেছিলাম? তাহলে একটি function লিখুন যা একটি fraction নিবে এবং তার inverse(বিপরীত) fraction return করবে। যেমনঃ ২/৩ এর বিপরীত ভগ্নাংশ হলো ৩/২

```
#include <stdio.h>

struct Fraction{
    int num;
    int denom;
};

//for input
struct Fraction Input(){
    struct Fraction f;
    scanf("%d %d",&f.num,&f.denom);
};

//for printing
struct Fraction fracPrint(struct Fraction a){
    struct Fraction f;
    printf("original: %d/%d\n",f.num,f.denom);
}

//inverse print
struct Fraction revFracPrint(struct Fraction a){
    struct Fraction f;
    printf("reverse: %d/%d\n",f.denom,f.num);
}

int main(){
    struct Fraction a;
    a=Input();
    fracPrint(a);
    //rever print
    revFracPrint(a);
}
```

Question No. 05

Remember the student structure we wrote.

```
struct Student {
    char name[100];
    int roll;
    int class;
    struct Date dob;
}
```

Show how you can update the name and roll of a student.

```
#include<stdio.h>
#include<string.h>

struct Date{
    int day;
    int month;
    int year;
};

struct Student{
    char name[100];
    int class;
    int roll;
    struct Date dob;//struct inside struct
};

int main(){
    struct Student st={
        .class=7,
        .roll=10,
        .dob={1,1,2000}
    };
    strcpy(st.name,"Nicola tesla");
    printf("name:%s roll:%d\n",st.name,st.roll);

    //update
    st.roll=11;
    strcpy(st.name,"Thomas Edison");
    printf("name:%s roll:%d\n",st.name,st.roll);
}
```

Question No. 06

How can you use a structure to return multiple values from a function. Give an example.

কীভাবে আপনি একটি স্ট্রাকচার ব্যবহার করে একটি ফাংশন থেকে একাধিক ভ্যালু রিটার্ন করবেন? একটি উদাহরণ লিখুন।

Ans: Yes we can return multiple values using struct. Below is an example, which can tell between two numbers,which one is greater or smaller.

```
#include<stdio.h>
#include<string.h>

struct numbers{
    int greater;
    int smaller;
};

// compare two unequal numbers
struct numbers compare(int a,int b){
    struct numbers f;
    if(a>b){
        f.greater=a;
        f.smaller=b;
    }
    else if(a<b){
        f.greater=b;
        f.smaller=a;
    }
    return f;
}

int main(){
    int a,b;
    scanf("%d %d",&a,&b);

    struct numbers res;
    res=compare(a,b);
    printf("greater: %d, smaller: %d",res.greater,res.smaller);
}
```

Question No. 07
Find the binary representation of the number 23.

```
#include<stdio.h>
#include<string.h>

void ToBinary(unsigned int val,char str[]){
   int i=0;
   while(val>0){
         int digit=val%2;
         val=val/2;
         //printf("%d",d);
         str[i]='0'+ digit;// int to char
         i++;
   }
   str[i]='\0';//end of string

   //printf("idx %d\n",idx);
   //before reverse
   // for(int i=0; i<idx; i++){
   //     printf("%c",str[i]);
   // }
   //reverse
   int j=0;
   char temp;
   while(j<i-1){
      temp=str[j];
      str[j]=str[i-1];
      str[i-1]=temp;
      j++;
      i--;
   }
}

int main(){
   char str[100];
   unsigned int v=23;//max 255//8 bit binary
   ToBinary(v,str);
   printf("binary %s\n",str);
```

```
    return 0;
}
```

Question No. 08
Write a program that takes input two integers l and r and finds the xor of all numbers between l and r.
একটি প্রোগ্রাম লিখুন যা দুটি ইন্টিজার সংখ্যা l ও r ইনপুট নেয় এবং l ও r এর মধ্যবর্তী সকল সংখ্যার xor নির্ণয় করে।

```
//here l and r cosidered as a and b
#include <stdio.h>
int main(){
    int a=1,b=9;//inclusive
    int res=0;

    for(int i=a; i<=b; i++){
        //printf("%d",i);
        res=res^i;
    }
    printf("%d",res);
}
```

Question No. 09

Suppose you want to flip the leftmost one bit of a number. For example, 00101100 would become 00001100. The leftmost 1 bit became a zero. Write a program to do that.

মনে করুন, আপনি একটি সংখ্যার সর্ববামের এক বিটটিকে ফ্লিপ করতে চাইছেন। উদাহরণস্বরুপ, 00101100 পরিবর্তিত হয়ে 00001100 হবে। সর্ববামের 1 বিটটি একটি শূন্য হবে। একটি প্রোগ্রাম লিখুন যা এই কাজটি করে।

```
/**
  * first find the  position of the leftmost set bit
  * then flip the bit at that position.
  */

#include <stdio.h>

int main()
{
    int a=44, n=0, b;

    // get postition of leftmost set bit (1)
    int num=a;
    int pos=0;
    while(num>0){
        num=num>>1;
        pos++;
    }
    printf("%d\n",pos);
    n=pos-1; //for n=6, to 5th bit from right

     // Left shifts 1, n times
     // then perform bitwise XOR

    b = a ^ (1 << n);

    printf("before fliping %d (in decimal)\n",a);
    printf("after fliping %d (in decimal)\n", b);
    return 0;
}
```

Question No. 10

Suppose you want to make the last 4 bits of an integer 0. For example 11010011 becomes 11010000. How can you do it? Can you do it with only 2 bitwise operations?

মনে করুন, আপনি একটি ইন্টিজার সংখ্যার শেষের 4 টি বিটকে 0 করে দিতে চাইছেন। উদাহরণস্বরুপ, 11011100 পরিবর্তিত হয়ে 11010000 হবে। কীভাবে আপনি এটা করবেন? আপনি কী এটা শুধুমাত্র দুইটি বিটওয়াইজ অপারেশনের মাধ্যমে করতে পারবেন?

Ans: if we want to clear last 4 bits(from LSB to left 4 bits), we first have to make a mask by left shifting 1, 4 times and then minus 1.then all 4 bits(right most) becomes 1 and remaining bits become cleare or zero. Then complment the mask and do bitwise AND operation with the given number to reach our target.
Below is an example,shows the process.

```
#include<stdio.h>
#include<string.h>

int main(){

    //11010011 : 220
    //11010000: 208

    int p=220,k=4; //last kth bits
    int mask = ~((1 << k ) - 1);
    p=p & mask;
    printf("%d",p);
    return 0;
}
```

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