Ain Shams University, Faculty of Science. Math. Dept.
Final Exam: Spring Semester (2020/2021)
Date: Saturday19 June 2021

1st level student
Course No. 104 comp
Time Allowed 2 Hours

(90 Marks)

Answer All Questions

Question one [20 Marks]

I. [12 Marks] What is the output when the following code segment is executed?

a)
```
int x=3,y=4, a, b;
a = ( x+1 > 5 ? 10 : 20 ); cout<<"a="<<a<<endl;
b = ( x+y > x*y/2 ? (y+3 > 5 ? 30:40  ) : 0 ); cout<<"b="<< b <<endl;
```

Answer:
a=20
b=30

b)
```
int sum =0;
for (int i=1; i < 9; i++){
    if (i%2 == 0) sum+=i;
    else if (i%5 == 0) break;
cout << "sum"<<sum;
}
```

Answer:
sum0 sum2 sum2 sum6

c)
```
int i=1, f=3, s=1;
switch(i%3){
   case 1:   f+=1; cout<<"f="<<f ;
   case 2:   f+=2; cout<<"f="<<f ; break;
   default:  f+=3; cout<<"f="<<f ;
}
```

Answer:
f=4 f=6

d)
```
int t=0;
for(int i=1;i<=2;i++)
  for(int j=5;j<8;j+=2){
        t+=i*j;
        cout<<"i="<<i<<", j"<<j<<" ,t="<<t ;}
```

Answer:
i=1, j5 ,t=5
i=1, j7 ,t=12
i=2, j5 ,t=22
i=2, j7 ,t=36

II. [8 Marks] rewrite the following code after correcting the C++ syntax errors:

a)
```
FLOAT  $x=1,0=sum;
While{$x not equal 0}( input x; sum+= $x*$x;)
```

Answer:
```
float  x=1, sum=0;
while(x != 0){ cin>>x; sum+= x*x;}
```

b)
```
double  x=1 ,y =0;
do;[
y+= x % 3; x++;
]while{1/x > 0.01},
```

Answer:
```
double  x=1 ,y =0;
```

```
do{
y+= (int)x % 3; x++;
}while(1/x > 0.01);
```

Question Two [20 Marks]

Implement the following using C++ code:

a) Write C++ for-loop to compute:

$$sum = 1^2 - 2^2 + 3^2 - 4^2 + \cdots + (-1)^{n+1}n^2$$

Answer:

```
int sum=0, n,sign=1;;
cin>>n;
for(int i=1;i<=n ; i++){
  sum+=sign*i*i;
  sign*=-1;
}
```

b) Write C++ switch-statement to compute (you can use if-statement in the body of switch-statement).

$$f(x) = \begin{cases} x^2 : x \in \{2,5,7\} \\ x+1 : x \in \{3,6\} \\ x^3 : x < 0 \\ 0 : otherwise \end{cases}$$

Answer:

```
int x,f;
cin>>x;
switch(x){
case 2: case 5: case 7: f=x*x; break;
case 3: case 6: f=x+1;break;
default:
        if(x<0) f=x*x*x*x;
        else f=0;
}
cout<<"f="<<f<<endl;
```

c) Use C++ nested loop to compute:

$$sum = \sum_{i=3}^{10} \sum_{j=i+1}^{15} (i + i \times j)$$

Answer:

```
int sum=0;
for(int i=3;i<=10;i++)
    for(int j=i+1;j<=15;j++)
      sum+=i+i*j;
cout<<"sum="<<sum<<endl;
```

d) Define X and Y to be two arrays of 100 integers. Write the C++ code to compute the ratio min/max where min is the smallest element and max is the largest element.

Answer:

```
int X[100], Y[100],min,max;
cout<<"Enter array X";
for(int i=0;i<100;i++)cin>>X[i];
cout<<"Enter array Y";
for(int i=0;i<100;i++)cin>>Y[i];

max=X[0]; min = X[0];
for(int i=0;i<100;i++){
    if(X[i]< min) min=X[i];
```

```
    else if(X[i]>max)max=X[i];

    if(Y[i]< min) min=Y[i];
    else if(Y[i]>max)max=Y[i];

}
cout<<"ratio="<<(double)min/max<<endl;
```

Question Three [24 Marks]

I. [10 Marks] Trace the following C++ code and conclude the output:

```
int i=1, f=5, s=2;
while( i <= 7){
if(i%2==0){
  switch(i%3){
     case 1:   f+=i; break;
     case 2:   f+=4; break;
     default:  f+=2;
 }
   s*=f;
}
 cout<<"i="<<i<<",  f="<<f <<",  s="<<s<<endl;
 if(f > 12) break;
 i++;}
```

Answer:

```
i=1,  f=5,  s=2
i=2,  f=9,  s=18
i=3,  f=9,  s=18
i=4,  f=13,  s=234
```

II. [14 Marks] Write a C++ program to read two running times (as input) $T_1 = h_1:m_1:s_1$ and $T_2 = h_2:m_2:s_2$ (hours : minutes : seconds) and then finding the difference between them. For example, the difference of the two running times T1 = 90 : 1 : 6 and T2 = 92: 3 : 8 is 2 : 2 : 2 i.e., 2 hours : 2 minutes : 2 seconds. Your code must keep the run using Do-While-loop.

Answer:

```
#include<iostream>
using namespace std;
void main(){
  int h1,m1,s1;
  int h2,m2,s2;
int key;
do{
  cout<<"Enter run time 1"<<endl;
  cin>>h1>>m1>>s1;
  cout<<"Enter run time 2"<<endl;
  cin>>h2>>m2>>s2;

  int diff;
  diff = (h1*3600 + m1*60 + s1) - (h2*3600 + m2*60 + s2);

  int h3,m3,s3;
  h3 = diff/3600;
  m3 = (diff%3600)/60;
  s3 = (diff%3600)%60;
  cout<<"difference time ="<<h3<<":"<<m3<<":"<<s3<<endl;
  cout<<"Enter 1 to continue or another key to exit"<<endl; cin>>key;
}while(key==1);
  system("pause");
}
```

Question Four [26 Marks]

I. [14 Marks] Write a C ++ program that reads two arrays X and Y of 20 integers. Then

- **Print only the even integers located in the two arrays X and Y.**
- **Combine the two arrays X and Y into an array Z with no even integers, that is, the even integers in X and Y do not repeat in Z.**

Answer:

```
#include <iostream>
using namespace std;
int main()
{
int X[20], Y[20],Z[40];
cout<<"Enter array X: ";
for(int i=0;i<20;i++)cin>>X[i];

cout<<"Enter array Y: ";
for(int i=0;i<20;i++)cin>>Y[i];

cout<<"Even integers in X and Y are:\n";
for(int i=0;i< 20;i++){
   if(X[i]%2==0) cout<<"X["<<i<<"]="<<X[i]<<endl;
   if(Y[i]%2==0) cout<<"Y["<<i<<"]="<<Y[i]<<endl;
}

int j=0;
for(int i=0;i< 20;i++){
   if(X[i]%2==1) {Z[j]=X[i]; ++j;};
   if(Y[i]%2==1) {Z[j]=Y[i]; ++j;};
}
cout<<"Array Z:"<<endl;
for(int i=0;i<j;i++)
   cout<<"Z["<<i<<"]="<<Z[i]<<", ";
cout<<endl;
 return 0;
}
```

II. [12 Marks] Let M be a given matrix (5 x 4) of the grades of some courses where a row contains the grades of a course. Write C ++ code to implement the following:

- **Initialize M to be as follows:**

M	0	1	2	3
0	43	67	88	90
1	65	77	78	80
2	78	90	58	87
3	48	67	86	89
4	52	75	45	55

- **Increase the grades by 5% and then display them.**
- **Calculate the total grade for each course, that is, the sum of grades for each row.**

Answer:

```
double M[5][4]={
      {43, 67,88,90},
      {65,77,78,80},
```

```
        {78,90,58,87},
        {48,67,86,89},
        {52,75,45,55}
    };

    for(int i=0;i<5;i++){
        for(int j=0;j<4;j++){
            M[i][j]+=0.05*M[i][j];
            cout<<setw(5)<<M[i][j];
        }
        cout<<endl;
    }


    for(int i=0;i<5;i++){
        double sum=0;
        for(int j=0;j<4;j++){
            sum+=M[i][j];
        }
        cout<<"total="<<sum<<endl;
        cout<<endl;
    }
```

بالنجاح والتوفيق

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