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Programming-1 CS112 **Practice problems (Loops)** Dr. Amin Allam

⇒ Problem 1

Write a program that takes an input integer n (assume $n \geq 1$) and prints the value of the sum $1^2 + 2^2 + 3^2 + \cdots + n^2$. For example, if the user inputs 3, the program should output the value of $1^2 + 2^2 + 3^2 = 1 + 4 + 9$ which is 14. If the user inputs 5, the program should output the value of $1^2 + 2^2 + 3^2 + 4^2 + 5^2$ which is 55. If the user inputs $n \leq 0$ print "Error".

Input: 1	Output: 1	Input: 2	Output: 5
Input: 3	Output: 14	Input: 4	Output: 30
Input: 5	Output: 55	Input: 10	Output: 385
Input: 0	Output: Error	Input: -5	Output: Error

```
1  #include <iostream>
2  using namespace std;
3
4  int main()
5  {
6     int i, n;
7     cin>>n;
8     if(n<=0) {cout<<"Error"<<endl; return 0;}
9
10    int sum=0;
11    for(i=1; i<=n; i++) sum+=i*i;
12    cout<<sum<<endl;
13
14    return 0;
15 }
```

⇒ Problem 2

Write a program that takes an input integer n (assume n is odd and $n \geq 1$) and prints the value of the sum $1+3+5+\cdots+n$. For example, if the user inputs 5, the program should output the value of $1+3+5$ which is 9. If the user inputs 9, the program should output the value of $1+3+5+7+9$ which is 25. If the user inputs $n \leq 0$ or even value of n print "Error".

Input: 1	Output: 1	Input: 3	Output: 4
Input: 5	Output: 9	Input: 7	Output: 16
Input: 9	Output: 25	Input: 19	Output: 100
Input: -5	Output: Error	Input: 8	Output: Error

```cpp
#include <iostream>
using namespace std;

int main()
{
   int i, n;
   cin>>n;
   if(n<=0 || n%2==0) {cout<<"Error"<<endl; return 0;}

   int sum=0;
   for(i=1; i<=n; i+=2) sum+=i;
   cout<<sum<<endl;

   return 0;
}
```

⇒ Problem 3

Write a program that takes an input integer n (assume n is even and $n \geq 2$) and prints the value of the sum $2 + 4 + 6 + \cdots + n$. For example, if the user inputs 6, the program should output the value of $2 + 4 + 6$ which is 12. If the user inputs 10, the program should output the value of $2 + 4 + 6 + 8 + 10$ which is 30. If the user inputs $n \leq 0$ or odd value of n print "Error".

`Input: 2 Output: 2`	`Input: 4 Output: 6`
`Input: 6 Output: 12`	`Input: 8 Output: 20`
`Input: 10 Output: 30`	`Input: 20 Output: 110`
`Input: -2 Output: Error`	`Input: 3 Output: Error`

```cpp
#include <iostream>
using namespace std;

int main()
{
    int i, n;
    cin>>n;
    if(n<=0 || n%2==1) {cout<<"Error"<<endl; return 0;}

    int sum=0;
    for(i=2; i<=n; i+=2) sum+=i;
    cout<<sum<<endl;

    return 0;
}
```

⇒ Problem 4

Write a program that takes an input integer n (assume $n \geq 1$) and prints the value of the sum $\frac{1}{1^2} + \frac{1}{2^2} + \frac{1}{3^2} + \cdots + \frac{1}{n^2}$. For example, if the user inputs 3, the program should output the value of $\frac{1}{1^2} + \frac{1}{2^2} + \frac{1}{3^2} = 1 + 0.25 + 0.11$ which is 1.36. If the user inputs 5, the program should output the value of $\frac{1}{1^2} + \frac{1}{2^2} + \frac{1}{3^2} + \frac{1}{4^2} + \frac{1}{5^2}$ which is 1.46. If the user inputs $n \leq 0$ print "Error".

Input: 1	Output: 1	Input: 2	Output: 1.25
Input: 3	Output: 1.36	Input: 4	Output: 1.42
Input: 5	Output: 1.46	Input: 10	Output: 1.55
Input: 0	Output: Error	Input: -3	Output: Error

```
1  #include <iostream>
2  using namespace std;
3
4  int main()
5  {
6     int i, n;
7     cin>>n;
8     if(n<=0) {cout<<"Error"<<endl; return 0;}
9
10    double sum=0;
11    for(i=1; i<=n; i++) sum+=1.0/(i*i);
12    cout<<sum<<endl;
13
14    return 0;
15 }
```

⇒ Problem 5

Write a program that takes an input integer n (assume n is odd and $n \geq 1$) and prints the value of the sum $\frac{1}{1} + \frac{1}{3} + \frac{1}{5} + \cdots + \frac{1}{n}$. For example, if the user inputs 5, the program should output the value of $\frac{1}{1} + \frac{1}{3} + \frac{1}{5} = 1 + 0.33 + 0.20$ which is 1.53. If the user inputs 9, the program should output the value of $\frac{1}{1} + \frac{1}{3} + \frac{1}{5} + \frac{1}{7} + \frac{1}{9}$ which is 1.79. If the user inputs $n \leq 0$ or even value of n print "Error".

Input: 1	Output: 1	Input: 3	Output: 1.33
Input: 5	Output: 1.53	Input: 7	Output: 1.68
Input: 9	Output: 1.79	Input: 19	Output: 2.13
Input: -2	Output: Error	Input: 6	Output: Error

```cpp
#include <iostream>
using namespace std;

int main()
{
    int i, n;
    cin>>n;
    if(n<=0 || n%2==0) {cout<<"Error"<<endl; return 0;}

    double sum=0;
    for(i=1; i<=n; i+=2) sum+=1.0/i;
    cout<<sum<<endl;

    return 0;
}
```

⇒ Problem 6

Write a program that takes an input integer n (assume n is even and $n \geq 2$) and prints the value of the sum $\frac{1}{2} + \frac{1}{4} + \frac{1}{6} + \cdots + \frac{1}{n}$. For example, if the user inputs 6, the program should output the value of $\frac{1}{2} + \frac{1}{4} + \frac{1}{6} = 0.5 + 0.25 + 0.17$ which is 0.92. If the user inputs 10, the program should output the value of $\frac{1}{2} + \frac{1}{4} + \frac{1}{6} + \frac{1}{8} + \frac{1}{10}$ which is 1.14. If the user inputs $n \leq 0$ or odd value of n print "Error".

Input: 2	Output: 0.5	Input: 4	Output: 0.75
Input: 6	Output: 0.92	Input: 8	Output: 1.04
Input: 10	Output: 1.14	Input: 20	Output: 1.46
Input: -2	Output: Error	Input: 3	Output: Error

```cpp
#include <iostream>
using namespace std;

int main()
{
   int i, n;
   cin>>n;
   if(n<=0 || n%2==1) {cout<<"Error"<<endl; return 0;}

   double sum=0;
   for(i=2; i<=n; i+=2) sum+=1.0/i;
   cout<<sum<<endl;

   return 0;
}
```

⇒ Problem 7

Write a C++ program that takes an input integer n (assume n is odd and $n \geq 1$) and prints the value of the sum $(\frac{1}{2}+\frac{2}{1})^2+(\frac{3}{4}+\frac{4}{3})^2+(\frac{5}{6}+\frac{6}{5})^2+\cdots+(\frac{n}{n+1}+\frac{n+1}{n})^2$. For example, if the user inputs 5, the program should output the value of $(\frac{1}{2}+\frac{2}{1})^2+(\frac{3}{4}+\frac{4}{3})^2+(\frac{5}{6}+\frac{6}{5})^2$ which is 14.72. If the user inputs $n \leq 0$ or even value of n print "Error".

Input: 1 Output: 6.25	Input: 3 Output: 10.59
Input: 5 Output: 14.72	Input: 7 Output: 18.80
Input: 9 Output: 22.84	Input: 11 Output: 26.87
Input: 8 Output: Error	Input: -5 Output: Error

```cpp
#include <iostream>
using namespace std;

int main()
{
   int i, n;
   cin>>n;
   if(n<=0) {cout<<"Error"<<endl; return 0;}

   double sum=0;
   for(i=1; i<=n; i+=2)
   {
      double v=(double)i/(i+1)+(double)(i+1)/i;
      sum+=v*v;
   }
   cout<<sum<<endl;

   return 0;
}
```

⇒ Problem 8

Write a C++ program that takes an input integer n (assume n is odd and $n \geq 1$) and prints the value of the sum $(\frac{1}{1}+\frac{1}{2})^2+(\frac{1}{3}+\frac{1}{4})^2+(\frac{1}{5}+\frac{1}{6})^2+\cdots+(\frac{1}{n}+\frac{1}{n+1})^2$. For example, if the user inputs 5, the program should output the value of $(\frac{1}{1}+\frac{1}{2})^2+(\frac{1}{3}+\frac{1}{4})^2+(\frac{1}{5}+\frac{1}{6})^2$ which is 2.72. If the user inputs $n \leq 0$ or even value of n print "Error".

Input: 1 Output: 2.25	Input: 3 Output: 2.59
Input: 5 Output: 2.72	Input: 7 Output: 2.80
Input: 9 Output: 2.84	Input: 11 Output: 2.87
Input: 8 Output: Error	Input: -5 Output: Error

```cpp
#include <iostream>
using namespace std;

int main()
{
   int i, n;
   cin>>n;
   if(n<=0) {cout<<"Error"<<endl; return 0;}

   double sum=0;
   for(i=1; i<=n; i+=2)
   {
      double v=1.0/i+1.0/(i+1);
      sum+=v*v;
   }
   cout<<sum<<endl;

   return 0;
}
```

⇒ Problem 9

Write a program that takes an input integer n (assume $n \geq 1$) and prints the value of the sum $\frac{1}{1^2} - \frac{1}{2^2} + \frac{1}{3^2} - \frac{1}{4^2} + \cdots + \frac{1}{n^2}$. For example, if the user inputs 3, the program should output the value of $\frac{1}{1^2} - \frac{1}{2^2} + \frac{1}{3^2} = 1 - 0.25 + 0.111$ which is 0.861. If the user inputs 5, the program should output the value of $\frac{1}{1^2} - \frac{1}{2^2} + \frac{1}{3^2} - \frac{1}{4^2} + \frac{1}{5^2}$ which is 0.839. If the user inputs $n \leq 0$ print "Error".

Input: 1 Output: 1	Input: 2 Output: 0.75
Input: 3 Output: 0.861	Input: 4 Output: 0.799
Input: 5 Output: 0.839	Input: 10 Output: 0.826
Input: 0 Output: Error	Input: -3 Output: Error

```cpp
#include <iostream>
using namespace std;

int main()
{
   int i, n;
   cin>>n;
   if(n<=0) {cout<<"Error"<<endl; return 0;}

   double sum=0;
   for(i=1; i<=n; i++)
   {
      if(i%2==1) sum+=1.0/(i*i);
      else sum-=1.0/(i*i);
   }
   cout<<sum<<endl;

   return 0;
}
```

⇒ Problem 10

Write a program that takes an input integer n (assume n is odd and $n \geq 1$) and prints the value of the sum $\frac{1}{1} - \frac{1}{3} + \frac{1}{5} - \frac{1}{7} + \cdots + \frac{1}{n}$. For example, if the user inputs 5, the program should output the value of $\frac{1}{1} - \frac{1}{3} + \frac{1}{5} = 1 - 0.33 + 0.20$ which is 0.867. If the user inputs 9, the program should output the value of $\frac{1}{1} - \frac{1}{3} + \frac{1}{5} - \frac{1}{7} + \frac{1}{9}$ which is 0.835. If the user inputs $n \leq 0$ or even value of n print "Error".

Input: 1 Output: 1	Input: 3 Output: 0.667
Input: 5 Output: 0.867	Input: 7 Output: 0.724
Input: 9 Output: 0.835	Input: 19 Output: 0.760
Input: -2 Output: Error	Input: 6 Output: Error

```cpp
#include <iostream>
using namespace std;

int main()
{
   int i, n;
   cin>>n;
   if(n<=0 || n%2==0) {cout<<"Error"<<endl; return 0;}

   double sum=0;  int k=0;
   for(i=1; i<=n; i+=2)
   {
       if(k%2==0) sum+=1.0/i;
       else sum-=1.0/i;
       k++;
   }
   cout<<sum<<endl;

   return 0;
}
```

Another solution:

```cpp
   double sum=0;  int k=1;
   for(i=1; i<=n; i+=2)
   {
       sum+=k*(1.0/i);
       k=-k;
   }

```

⇒ Problem 11

Write a C++ program (use *switch* statement, do not use *if* statements) that takes two input numbers a, b and a character c. If c is the '+' character, the program should output the value of $a + b$, and similarly for the multiply, divide, and subtract operations as shown in the following examples. If c in not one of these characters: '+', '-', '*', '/' print "Error".

Input: 3.5 4 + Output: 7.5	Input: 9 5 - Output: 4	Input: 5 2 / Output: 2.5	Input: 6 7 = Output: Error

```cpp
#include <iostream>
using namespace std;

int main()
{
   double a, b;
   char c;
   cin>>a>>b>>c;

   switch(c)
   {
   case '+': cout<< a+b <<endl; break;
   case '-': cout<< a-b <<endl; break;
   case '/': cout<< a/b <<endl; break;
   case '*': cout<< a*b <<endl; break;
   default: cout<< "Error" <<endl;
   }

   return 0;
}
```

⇒ Problem 12

Write a C++ program that takes an input integer n (where $n \geq 1$) and two characters a and b, and produces n lines of output, the i^{th} line is a sequence of i alternating a and b characters as shown in the following examples. If the user inputs $n \leq 0$ print "Error".

Input: 4 x y Output: x xy xyx xyxy	Input: 5 * - Output: * *- *-* *-*- *-*-*	Input: 3 ;) Output: ; ;) ;);	Input: 0 s z Output: Error

```cpp
#include <iostream>
using namespace std;

int main()
{
   int a;
   char b,c;
   cin>>a>>b>>c;

   int i,j;

   for(i=1; i<=a; i++)
   {
      for(j=0; j<i; j++)
      {
         if(j%2==0) cout<<b;
         else cout<<c;
      }
      cout<<endl;
   }

   return 0;
}
```

⇒ Problem 13

Write a C++ program that takes an input integer n (where $n \geq 1$) and two characters a and b, and produces n lines of output, the i^{th} line is a sequence of size i consisting of a or b characters depending on whether i is even or odd as shown in the following examples. If the user inputs $n \leq 0$ print "Error".

Input: 4 x y	Input: 5 * -	Input: 3 ;)	Input: 0 s z
Output:	Output:	Output:	Output:
x	*	;	Error
yy	--	))	
xxx	***	;;;	
yyyy	----		
	*****		

```cpp
#include <iostream>
using namespace std;

int main()
{
   int a;
   char b,c;
   cin>>a>>b>>c;

   int i,j;

   for(i=1; i<=a; i++)
   {
      for(j=0; j<i; j++)
      {
         if(i%2==1) cout<<b;
         else cout<<c;
      }
      cout<<endl;
   }

   return 0;
}
```