

Decision making and looping

REVIEW QUESTIONS

6.1 State whether the following statements are true or false:

(a) The do... while statement first executes the loop body and then evaluate the loop control expression.

Ans: True.

(b) In a preset loop, if the body is executed n terms, the test expression is executed n+1 times.

Ans: True.

(c) The number of times a control variable is updated always equals the number of loop iterations.

Ans: True.

(d) Both the preset loops include initialization within the statement.

Ans: True.

(e) In a for loop expression, the starting value of the control variable must be less than its ending value.

Ans: True.

(f) The initialization, test condition and increment parts may be missing in a for statement.

Ans: False.

(g) While loops can be used to replace for loops without any change in the body of the loop.

Ans: False.

(h) An exit control loop is executed a minimum of a one line.

Ans: False.

(i) The use of continue statement considered as unstructured programming.

Ans: True.

(j) The three loop expressions used in a for loop header must be separated by commas.

Ans: True.

6.2: Fill in the blanks in the following statements.

(a) In an exit controlled loop, if body is executed n times, test condition is evaluated

times.

Ans: (n-1)

(b) The statements is use to skip a part of the statements in a loop.

Ans: continue.

(c) A for loop with the no test condition is known as loop.

Ans: infinite

(d) The sentinel controlled loop is also; known as loop.

Ans: indefinite repetition.

(e) In a counter controlled loop, variable known as is used to count the loop operation.

Ans: definite repetition.

6.8 explain the operation of each of the following for loops.

(a) for (n=1; n!=10; n+=2)

sum=sum+n;

Ans :The loop repeats 5 times.

```
(b)for(n=5;n<=m;n-=1)
```

```
sum+=n;
```

Ans: The continue until $n \leq m$ where m initializes from 5 and decrements by 1.

```
(c) for(n=1;n<=5)
```

```
sum+=n;
```

Ans: Since there is no increment or decrement condition the loop repeats 5 times.

```
(d) for(n=1; ;n+=1)
```

```
sum+=n;
```

Ans: The loop repeats infinity times.

```
(e)for(n=1;n<5;n++)
```

```
n=n-1;
```

Ans: The loop repeats infinity times.

6.9: what would be the output of each of the following code segments?

```
(a)count=5;
```

```
while(count-- >0)
```

```
printf("count");
```

Output:

5 4 3 2 1

```
(b)count=5;
```

```
while(-- count>0)
```

```
Printf("count");
```

Output:

4 3 2 1

```
(c) count=5;
```

```
do printf("count");
```

```
while(count>0)
```

Output:

5 4 3 2 1

```
(d)for(m=10;m>7;m-=2)
```

```
printf("m");
```

```
output;
```

10 8

6.11:Analyse each of the program segment that follow the determine how many times the body of each loop will be executed.

```
(a)x=5;
```

```
y=50;
```

```
while(x<=y)
```

```
{
```

```
x=y/x;
```

```
.....
```

```
.....
```

```
}
```

Ans: Infinity times

```
(b) m=1;
do
{
.....
.....
m+=2;
}
while(m<10)
```

Ans: 5 times.

```
(c) int i;
for(i=0;i<=5;i=i+2/3)
{
.....
.....
}
```

Ans: Infinity times.

```
(d) int m=10;
Int n=7;
while(m%n>=0)
{
```

.....

m+=1;

n+=2;

.....

}

Ans: 4 times.

6.12: Find errors, if any, in each of the following looping segments. Assume that all the variables have been declared and assigned values.

(a)while(count!=10);

{

count=1;

sum+=x;

count+=1;

}

Error: while(count!=10);

Correct Ans: while(count!=10)

(b) name=0;

do

{

name+=1;

printf("my name is Dinar\n");

while(name=1);

Error: while (name=1);

Correct Ans: while(name==1);

(c) do;

total+=value;

scanf("%f",&value);

while(value!=999);

Error: do;

Correct Ans: do

(E) m=1;

n=0;

for(p=10;p>0;)

p-=1;

printf("%f",p);

Error: for(p=10;p>0;)

p-=1;

printf("%f",p);

Correct ans: for(p=10;p>0;)

{

p-=1;

printf("%f",p);

}

6.13: Write a for statement to print each of the following sequence of integers:

(a) 1,2,4,8,16,32

Ans: `for(i=1;i<=32;i=i*2)`

`printf("%d",i);`

(b) 1,3,9,27,81,243

Ans: `for(i=1;i<=243;i=i*i)`

`printf("%d",i);`

(c) -4,-2,0,4

`for(i=-4;i<=4;i=i+2)`

`printf("%d",i);`

(d) -10,-12,-14,-18,-26,-42

`for(i=-10;i<=-42;i=i-2)`

`printf("%d",i);`

6.14: Change the following for loops to while loops :

(a)`for(m=1;m<10;m=m+1)`

`printf("m");`

Ans: `m=1;`

`while(m<10)`

`{`

`.....`

`m++;`


```
}  
  
printf("m");  
  
(b)for(;scanf("%d",&m)!=-1;)   
  
printf("m");
```

Ans:

```
while(scanf("%d",&m)!=-1)  
  
printf("m");
```

6.16: What is the output of following code?

```
Int m=100,n=0;  
  
while(n==0)  
  
{  
  
if(m<10)  
  
break;  
  
m=m-10;  
  
}
```

Output: No output

6.17: What is output of the following code?

```
int m=0;  
  
do  
  
{  
  
if(m>10)
```

```
continue;  
m=m+10;  
}  
while(m<50);  
printf(“%d”,m);
```

Output: 50

6.18: What is the output of the following code?

```
int n=0,m=1;  
do  
{  
printf(“m”);  
m++;  
}  
while(m<=n);
```

Output: 1

6.19: What is the output of the following code?

```
int n=0,m;  
for(m=1;m<=n+1;m++)  
    printf(“m”);
```

Output: 1

6.20: When do we use the following statement?

for(;;)

Ans : When we need an infinity loop the statement for(;;) can be used.

Programming exercises

Problem 6.1: Given a integer number write using while loop to reverse the digit of the number. For example, the number

12345

should be written as

54321

Solution:

```
/*.....reverse number .....*/
```

```
#include
```

```
#include
```

```
void main()
```

```
{
```

```
clrscr();
```

```
long int n,b;
```

```
printf("\n\n Input number:");
```

```
scanf("%ld",&n);
```

```
while(n>10)
```

```
{
```

```
b=n%10;
```

```
printf("The reversed number is:%ld",b);
```

```

n=n/10;

}

printf("%ld",n);

getch();

}

```

Problem 6.2: The factorial of an integer m is the product of consecutive integers from 1 to m. that is

Factorial $m=m!=m*(m-1)*.....*1$.

Write a program that computes and print the result for any given m.

Solution :

```

/*.....factorial.....*/

#include

#include

void main()

{

int sum,i,m;

clrscr();

printf("Input number:");

scanf("%d",&m);

sum=1;

for(i=m;i>1;i--)

sum*=i;

```

```
printf("The result is: %d",sum);

getch();

}
```

Problem 6.3: Write a program that compute the sum of the digit of a given integer number.

Solution:

```
/*.....sum of given integer number.....*/

#include

#include

void main()

{

clrscr();

long int n,b,sum=0;

printf("\n\nInput number:");

scanf("%ld",&n);

while(n>10)

{

b=n%10;

printf("%ld+",b);

n=n/10;

sum+=b;
```

```

}

sum+=n;

printf("the result is= %ld",sum);

getch();

}

```

Problem 6.4: The numbers in the sequence

1 1 2 3 5 8 13 21.....

Are called Fibonacci numbers. Write a program using a do-while loop to calculate and print the Fibonacci numbers.

Solution :

```

/*.....Fibonacci sequence.....*/

#include

#include

void main()

{

clrscr();

int m,x,y,n,z;

m=0;

x=0;

y=1;

printf("\n\nInput number of count:");

scanf("%d",&n);

```

```

printf("%d",y);

do{

z=x+y;

x=y;

y=z;

m++;

printf(" the result= is %d",z);

}while(m<n);< span=""></n>;< >

getch();

}

```

Problem 6.5: The numbers in the sequence

1 1 2 3 5 8 13 21.....

Are called Fibonacci numbers. Write a program using a for loop to calculate and print the Fibonacci numbers.

Solution :

```

/*.....Fibonacci sequence.....*/

#include

#include

void main()

{

clrscr();

int x,y,n,z,i;

```

```

x=0;

y=1;

printf("\n\nInput number:");

scanf("%d",&n);

printf("%d",y);

for(i=1;i<=n;i++)

{

z=x+y;

x=y;

y=z;

printf(" the result= %d",z);

}

getch();

}

```

Problem 6.6: Write a program to evaluate the following investment equation

$$V=P(1+r)^n$$

And print the tables which would give the value of V for various combination of the following values of P,r and n.

Solution:

```

/*.....investment equation.....*/

#include

#include

```



```
#include

void main()

{

int i,n,p,j;

double v,r,t;

printf("\n\n\n");

clrscr();

r=0.10;

n=10;

p=1000;

t=pow((1+r),i);

// printf("\n\n%.6lf ",t);

printf("\nP R N V\n");

for(i=1;i<=n;i++)

{

if(r<=0.20 && p<=10000)

{

t=pow((1+r),i);

v=p*t;

p=p+1000;

r=r+0.01;
```

```

}
printf("%d %lf %d ",p,r,n);
printf("V=% .6lf ",v);
printf("\n");
}
getch();
}

```

Problem 6.7(a): Write the program to print the following outputs using for loops.

1

2 2

3 3 3

4 4 4 4

5 5 5 5 5

Solution :

```

/*.....trivues.....*/

```

```

#include

```

```

#include

```

```

Void main()

```

```

{

```

```

int i,j,n;

```

```

clrscr();

```

```

printf("\n\n Input number:");

scanf("%d",&n);

for(i=1;i<=n;i++)

{

for(j=1;j<=i;j++)

{

printf("%d",i);

printf(" ");

}

printf("\n");

}

getch();

}

```

Problem 6.7(b): Write programs to print the following outputs using for loops.

```
* * * * *
```

```
* * * *
```

```
* * *
```

```
* *
```

```
*
```

Solution:

```
/*.....star.....*/
```

```
#include

#include

void main()

{

int i,j,n,c;

clrscr();

printf("Input number:");

scanf("%d",&n);

for(i=1;i<=n;i++)

{

for(j=1;j<=n;j++)

{

c=i;

if(c>j)

{

printf(" ");

c++;

}

else

printf("*");

}
```

```
printf("\n");  
  
getch();  
  
}
```

Problem 6.8: Write a program to read the age of 100 persons and count the number of persons in the age group 50 to 60. Use for and continue statements.

Solution:

```
/******age count into 50 to 60*****/  
  
#include  
  
#include  
  
void main()  
{  
  
clrscr();  
  
int count,i,age;  
  
count=0;printf("Input age of 100 persons:");  
  
for(i=1;i<=100;i++)  
{  
  
scanf("%d",&age);  
  
if(age>=50&&age<=60)  
count+=1;  
  
continue;  
  
}  
  
printf("the countable number is:%d",count);
```

```
getch();
```

```
}
```

Problem 6.9: We have two function of the type

$Y1 = \exp(-a \cdot x)$

$Y2 = \exp(-a \cdot x \cdot x/2)$

Plot the graphs of these function for x verifying from 0 to 5.0.

Without using continue statement.

Solution:

```
/*.....plotting two function.....*/
```

```
#include
```

```
#include
```

```
#include
```

```
void main()
```

```
{
```

```
clrscr(); printf("\n\n");
```

```
int i;
```

```
float a,x,y1,y2;
```

```
a=0.4;
```

```
printf(" Y.....>\n");
```

```
printf("0-----\n");
```

```
for(x=0;x<5;x+=0.25)
```

```
{
y1=(int)(50*exp(-a*x)+0.5);
y2=(int)(50*exp(-a*x*x/2)+0.5);
if(y1==y2)
{
if(x==2.5)
printf("x|");
else
printf(" |");
for(i=1;i<=(y1-1);++i)
printf(" ");
printf("#\n");
}
else if(y1>y2)
{
if(x==2.5)
printf("x|");
else
printf(" |");
for(i=1;i<=(y2-1);++i)
printf(" ");
```

```
printf("*");  
for(i=1;i<=(y1-y2-1);++i);  
printf("-");  
printf("0\n");  
}  
else  
{  
if(x==2.5)  
printf("x|");  
else  
printf(" |");  
for(i=1;i<=(y1-1);++i)  
printf(" ");  
printf("0");  
for(i=1;i<=(y2-y1-1);++i)  
printf("-");  
printf("*\n");  
}  
}  
printf(" |\n");  
getch();
```



```
}
```

Problem 6.10: Write a program to print a table of values of the function

$Y = \exp(-x)$

For x varying from 0.0 to 10.0 in steps of 0.10.

Solution:

```
/*.....y=exp(-x).....*/  
  
#include  
  
#include  
  
#include  
  
void main()  
  
    {  
clrscr();  
  
int i,j;  
  
float y;  
  
printf("\n\n.....\n");  
  
printf("x");  
  
for(i=0;i<10;i++)  
  
    {  
for(j=0;j<10;j++)  
  
    {  
y=exp(-i);
```

```
printf(" %.2f ",y);
```

```
}
```

```
printf("\n");
```

```
}
```

```
getch();
```

```
}
```

Problem 6.11: Write a program that will read a positive integer and determine and print its binary equivalent.

Solution:

```
/* .....to binary.....*/
```

```
#include
```

```
#include
```

```
void main()
```

```
{
```

```
char binary[20],temp[20];
```

```
int i,j,num;
```

```
clrscr();
```

```
i=0;
```

```
printf("\n\nEnter value:");
```

```
scanf("%d",&num);
```

```
while(num>=1)
```

```
{
```

```

temp[i++]= (num%2)+48;

num=num/2;

}

printf("\n\nthe binary equivalent is:");

for(j=i-1;j>=0;j--)

printf("%c",temp[j]);

getch();

}

```

Problem 6.12: Write a program using for and if statement to display the capital letter S in a grid of 15 rows and 18 columns as shown below.

```

*****

*****

*****

****

****

****

*****

*****

*****

****

****

****

```

Solution :

```
/*.....S grid.....*/
```

```
#include
```

```
#include
```

```
void main()
```

```
{
```

```
clrscr();
```

```
int row,col,i,j,k;
```

```
row=15;
```

```
col=18;
```

```
for(i=1;i<=row;i++)
```

```
{
```

```
if((i<=3)||(i>=7&& i<=9)||(i>=13&& i<=15))
```

```
{
```

```
for(j=1;j<col;j++)< span=""></col;j++)<>
```

```
printf("*");
```

```
printf("\n");
```

```
}
```

```

else if(i>=4&& i<=6)
{
for(j=1;j<=4;j++)
printf("*");
printf("\n");
}
else
{
for(j=1;j<=13;j++)
printf(" ");
for(j=1;j<=4;j++)
printf("*");
printf("\n");
}
}
getch();
}

```

Problem 6.13: Write a program to compute the value of Euler's number e , that is used as the base of natural logarithms. Use the following formula.

$$e = 1 + 1/1! + 1/2! + 1/3! + \dots + 1/n!$$

use a suitable loop construct. The loop must terminate when the difference between two successive values of e is less than 0.00001.

Solution:

```
/*.....Euler's number.....*/  
  
#include  
  
#include  
  
float fact(float i)  
  
{  
  
float f=1;  
  
int k;  
  
for(k=1;k<=i;k++)  
  
f*=k;  
  
return(f);  
  
}  
  
void main()  
  
{  
  
float e,a,b,d=1,temp;  
  
int i,j,k;  
  
clrscr();  
  
e=1;i=2;b=1;  
  
while(d>=0.00001)  
  
{  
  
temp=fact(i);
```

```

a=1/temp;

e=e+a;

d=b-a;

if(d>=0.00001)

b=a;

i++;

}

printf("\n\nthe result = %f",e);

getch();

}

```

Problem 6.14: Write programs to evaluate the following functions to 0.0001% accuracy.

(a) $\sin x = x - \frac{x^3}{3!} + \frac{x^5}{5!} - \frac{x^7}{7!} + \dots$

Solution:

```

/*.....sinx function.....*/

#include

#include

#include

double fact(double power)

{

double f=1;

int k;

```

```
for(k=1;k<=power;k++)  
f=f*k;  
return f;  
}  
void main()  
{  
int i=1;  
double x,term,deno,lob,sin,power=3;  
clrscr();  
scanf("%lf",&x);  
term=x;  
sin=x;  
while(term>=0.0001)  
{  
lob=pow(x,power);  
deno=fact(power);  
term=lob/deno;  
power+=2;  
if(i%2==1)  
sin=sin-term;  
else
```



```

sin=sin+term;

i++

}

printf("the result= %lf",sin);

getch();

}

```

Problem 6.14: Write programs to evaluate the following functions to 0.0001% accuracy.

(b) $\cos x = 1 - x^2/2! + x^4/4! - x^6/6! + \dots$

Solution:

```

/*.....cosx function.....*/

#include

#include

#include

double fact(double power)

{

double f=1;

int k;

for(k=1;k<=power;k++)

f=f*k;

return(f);

}

```

```
void main()

{

int i=1;

double x,term,deno,lob,cos,power=2;

clrscr();

scanf("%lf",&x);

term=1.0;

cos=1.0;

while(term>=0.0001)

{

lob=pow(x,power);

deno=fact(power);

term=lob/deno;

power+=2;

if(i%2==1)

cos=cos-term;

else

cos=cos+term;

i++;

}

printf("the result is= %lf",cos);
```

```
    getch();  
}
```

Problem 6.14(c): Write programs to evaluate the following functions to 0.0001% accuracy.

Sum=1+(1/2)²+(1/3)³+(1/4)⁴+.....

Solution:

```
/*.....accuracy.....*/  
  
#include  
  
#include  
  
#include  
  
void main()  
{  
  
    double term,deno,lob,sum;  
  
    clrscr();  
  
    term=1.0;  
  
    sum=1.0; lob=1.0;deno=2.0;  
  
    while(term>=0.0001)  
    {  
  
        term=lob/deno;  
  
        term=pow(term,deno);  
  
        sum+=term;  
  
        deno++; printf("%lf",sum);
```

```

}

printf("the sum= %lf",sum);

getch();

}

```

Problem6.15: The present value (popularly known as book value)of an item is given by the relationship

$$P=c(1-d)^n$$

Where c=original cost

D=rate of depreciation

N=number of years

P=present value after years.

If p is considered the scrap value at the end of useful life of the item, write a program to compute the useful life in years given the original cost, depreciation rate, and the scrap value.

Solution:

```

/*.....useful life in years.....*/

#include

#include

#include

void main()

{

    clrscr();

int n,c;

```

```

double d,p,lob,hor;

printf("Input original cost, rate of depreciation, present value");

scanf("%d%lf%lf",&c,&d,&p);

lob=log(p/c);

    hor=log(1-d);

n=lob/hor;

printf("year=%d",n); getch();

}

```

Problem 6.16(a): Write a program to print a square size 5 by using the character S as shown below

S S S S S

S S S S S

S S S S S

S S S S S

S S S S S

Solution :

```

/*.....square size.....*/

```

```

#include

```

```

#include

```

```

void main()

```

```

{

```

```

clrscr();

```

```

int i,j;

printf("\n\n");

for(i=0;i<=4;i++)

{

for(j=1;j<=5;j++)

printf(" S");

printf("\n\n");

}

getch();

}

```

Problem 6.16(b): Write a program to print a square size 5 by using the character S as shown below

S S S S S

S S

S S

S S

S S S S S

solution :

```

/*.....square size.....*/

```

```

#include

```

```

#include

```

```

void main()

```

```
{  
int i,j,n;  
clrscr();  
n=5; printf("\n\n");  
for(i=1;i<=n;i++)  
printf("s ");  
printf("\n\n");  
for(i=1;i<=n-2;i++)  
{  
printf("s ");  
for(j=1;j<=n-2;j++)  
printf(" ");  
printf("s\n\n");  
}  
for(i=1;i<=n;i++)  
printf("s ");  
printf("\n");  
getch();  
}
```

Problem 6.18 : Write the program to print all integers that are not divisible by 2 or 3 and lie between 1 and 100. Program should also account the number of such integers and print the result.

Solution:

```
/*.....count the number into 1-100 which r divisible 2 or 3.....*/  
  
#include  
  
#include  
  
void main()  
  
{  
  
int i,count,sum;  
  
clrscr();  
  
sum=0;  
  
count=0;  
  
for(i=1;i<=100;i++)  
  
{  
  
if(i%2!=0&& i%3!=0)  
  
{  
  
sum+=i;  
  
count++;  
  
printf("%d\n",i);  
  
}  
  
}  
  
printf("the sum of the value is :%d \nthe countable numbers is: %d",sum,count);  
  
getch();
```



```
}
```

Problem 6.19: Write a program to print a square of size 5 by using the character S as shown below:

S S S S S

S S S S S

S S O S S

S S S S S

S S S S S

Solution:

```
/*.....square with centre 0.....*/
```

```
#include
```

```
#include
```

```
void main()
```

```
{
```

```
int n,i,j,mid;
```

```
clrscr();
```

```
printf("\n\n");
```

```
scanf("%d",&n);
```

```
mid=(int)(n/2);
```

```
for(i=0;i<n;i++)< span=""></n;i++><>
```

```
{
```

```
for(j=0;j<n;j++)< span=""></n;j++><>
```

```

{
if(i==mid&& j==mid)
printf("0 ");
else
printf("s ");
}
printf("\n\n");
}
getch();
}

```

Problem 6.20: Given a set of 10 two-digit integer containing both positive and negative values, write a program using for loop to compute the sum of all positive values and print the sum and the number of values added. The program should use scanf to read the values and terminate when the sum exceeds 999. Do not use goto statement.

Solution:

```

/*.....sum positive number.....*/

#include

#include

void main()

{
nt sum,n,i,j=0;

sum=0;

```

```
clrscr();

printf("\n\nInput ten number both positive and negative:");

for(i=0;i<10;i++)

{

scanf("%d",&n);

if(n>0)

{

        sum+=n; j++;}

if(sum>999)

break;

}

printf("\n\nThe value of positive numbers is:%d\nand the countable number is:
%d",sum,j);

getch();

}
```

Reference:

<http://hstuadmission.blogspot.com/2010/12/solution-programming-in-ansi-c-chapter.html>