BITWISE OPERATORS

1. Which of the following is the correct output for the program given below?

```
#include<stdio.h>
int main( )
{
        int i=32 , j= 0x20, k, l, m ;
        k = i | j ;
        l = i & j ;
        m = k ^ l ;
        printf( “%d %d %d %d\n” , i, j, k, l, m );
        return 0 ;
}
```

A. 32 32 32 32 0
B. 0 0 0 0 0
C. 0 32 32 32 32
D. 32 32 32 32 32

2. Which of the following is the correct output for the program given below?

```
#include<stdio.h>
int main ( )
{
        int i=4, j= 8 ;
        printf( “%d %d %d\n” , i | j & j | i, i | j && j | i, i ^ j ) ;
        return 0 ;
}
```

A. 4 8 0 B. 1 2 1 C. 12 1 12 D. 0 0 0

3. If an unsigned int is 4 bytes wide then which of the following is the correct output for the program given below?

```
#include<stdio.h>
int main ( )
{
        unsigned int m = 32 ;
        printf( “%x\n”, ~m ) ;
        return 0 ;
}
```

A. ffffffff B. 00000000 C. fffffdf D. ddfdddfd

4. If an unsigned short int is 2 bytes wide then which of the following is the correct output for the program given below?

```
#include<stdio.h>
int main( )
{
        unsigned short int a = 0xffff ;
        ~a ;
        printf( “%x\n”, a ) ;
        return 0 ;
}
```

A. ffff B. 0000 C. 00ff D.ff00

5. Point out the error, if any, n the following program.

```
#include<stdio.h>
int main ( )
{
        unsigned int a, b, c, d, e, f ;
        a = b = c =d = e = f = 32 ;
        a<<= 2 ;
        b >>= 2 ;
        c ^= 2 ;
```

```
        d |= 2 ;
        e &= 2 ;

        f~= 2 ;
        printf( “%x %x %x %x %x %x\n” , a, b, c, d, e, f ) ;
        return 0 ;
}
```

6. To which numbering system can the binary number 1011011111000101 be easily converted to?

7. Which bitwise operator is suitable for checking whether a particular bit is on or off?

8. Which bitwise operator is suitable for turning off a particular bit in a number?

9. Which bitwise operator is suitable for putting on a particular bit in a number?

10. On left shifting, the bits from the left are rotated and brought to the right and accommodated where there is empty space on the right?
[True/false]

11. Left shifting a number by 1 is always equivalent to multiplying it by 2.[True/False]

12. Left shifting an unsigned int or char by 1 is always equivalent to multiplying it be 2. [Yes/No]

13. Which of the following is the correct output for the program given below?

```
#include<stdio.h>
int main( )
{
        printf( “%d>>%d %d>>%d\n”, 4>>1, 8>>1 ) ;
        return 0 ;
}
```

A. 4 1 8 1
B. 4>>1 8>>1
C. 2>>4 Garbage value>>Garbage value
D. 2 4

14. Assuming a 2-byte integer which of the following is the correct output for the program given below?

```
#include<stdio.h>
int main ( )
{
        printf( “%x\n”, -1 << 3 ) ;
        return 0 ;
}
```

A. ffff B. fff8 C.0 D. No output

15. Which of the following is the correct output for the program given below?

```
#include<stdio.h>
int main ( )
{
        unsigned int res ;
        res = ( 64 >> ( 2+1 -2) ) & ( ~( 1 <<2 )) ;
        printf( “%d\n”, res ) ;
        return 0 ;
}
```

A. 32 B. 64 C. 0 D. 128

16. Which of the following is the correct output for the program given below?

```
#include<stdio.h>
int main ( )
{
```

```
        printf( "%d %d\n" , 32 << 1, 32 << 0 ) ;
        printf( "%d %d\n" , 32 << -1, 32 << -0) ;
        printf( "%d %d\n" , 32 >> 1, 32 >> 0 ) ;
        printf( "%d %d\n" , 32 >> -1, 32 >> -0 ) ;
        return 0 ;
}
```

A. Garbage values

B. All zeroes

C.
```
64      32
0       32
16      32
0       32
```

D.
```
8       0
0       0
32      0
0       16
```

17. Which of the following is the correct output for the program given below?

```
#include<stdio.h>
int main( )
{
        unsigned char i = 0X80 ;
        printf( "%dn", i<<1 );
        return 0 ;
}
```

A. 0 B. 256 C. 100 D. None of the above

18. which of the following statements are correct about the program given below?

```
#include<stdio.h>
int main( )
{
        unsigned int m[ ] = { 0x01, 0x02, 0x04, 0x08, 0x10, 0x20, 0x40, 0x80 } ;
        unsigned char n, i ;
        scanf ( "%d", &n ) ;
        for ( i=0 ; i<= 7 ; i++ )
        {
                if ( n &m [ i ] )
                        printf ( "yes\n" ) ;
        }
        printf( "\n" ) ;
        return 0 ;
}
```

A. It will put off all bits that are on in the number n.
B. It will test whether the individual bits of n are on or off.
C. It will put on all the bits that are off in the number n.
D. It will report compilation errors in the if statement.

19. Which of the following statements are correct about the program given below?

```
#include<stdio.h>
char * fun ( unsigned int num, int base ) ;
int main( )
{
        char *s;
        s = fun ( 128,2 ) ;
        s = fun ( 128, 16 ) ;
        printf( "%s\n" , s ) ;
        return 0 ;
}
char * fun ( unsigned int num, int base )
{
        static char buff[33] ;
        char *ptr ;
        ptr = &buff [ sizeof ( buff ) -1 ]
        *ptr = '\0' ;
        do
```

```
        {
                *--ptr = "0123456789abcdef"[ num % base ] ;
                num/= base;
        } while ( num !=0 ) ;
        return ptr ;
}
```

A. It converts a number to a given base.
B. It converts a number to its equivalent binary.
C. It coverts a number to its equivalent hexadecimal.
D. It converts a number to its equivalent octal.

20.
```
#define CHARSIZE            8
#define MASK(y)             (1 << y % CHARSIZE )
#define  BITSLOT(y)         ( y / CHARSIZE )
#define  SET ( x,y )        ( x[ BITSLOT(y) ] |= MASK(y) )
#define TEST ( x, y )       ( x[ BITSLOT(y) ] & MASK(y) )
#define NUMSLOTS(n)         ( ( n + CHARSIZE – 1 ) / CHARSIZE )
```

Given the above macros how will you
- declare an array arr of 50 bits
- put the 20th bit on
- test whether the 40th bit is on or off

21. Consider the macros in question 20 above. On similar lines how will you define a macro that will clear a given bit in a bit array?

22. Which of the following is the correct output for the program given below?

```
#define P       printf ( "%d\n", ~1^~0 ) ;
#define M(P)    int main( )\
                {\
                        P\
                        return 0 ; \
                }
M( P )
```

A. 1 B. 0 C. -1 D. 2

23. Which of the following statements are correct about the program given below?

```
#include<stdio.h>
int main( )
{
        unsigned int num ;
        int c=0 ;
        printf( "enter a number." ) ;
        scanf( "%u" , &num ) ;
        for ( ; num ; num>>=1 )
        {
                if ( num & 1 )
                c++ ;
        }
        printf( "%d\n" , c ) ;
        return 0 ;
}
```

A. It counts the number of bits that are on in the number num.
B. It sets all bits in the number num to 1.
C. It sets all bits in the number num to 0.
D. None of the above.

24. Assuming a 2-byte integer which of the following is the correct output for the program given below?

```
#include<stdio.h>
int main( )
{
```

```
        printf( "%x\n" , -1>>4 ) ;
        return 0 ;
}
```

A. ffff B. 0fff C. 0000 D. fff0

25. In the statement expression1 >> expression2 if expression1 is a signed integer with its leftmost bit set to 1 then on right-shifting it the result of the statement will vary from computer to computer.
[True/False]

26. Which of the following statements are correct about the program given below?

```
#include<stdio.h>
int main( )
{
        unsigned int num ;
        int i ;
        scanf( "%u", &num ) ;
        for ( i=0 ; i<16 ; i++ )
                printf( "%d", (num<<i & 1<<15 ) ? 1 : 0 ) ;
        printf( "\n" ) ;
        return 0 ;
}
```

A. It prints all even bits from num.
B. It prints all odd bits from num.
C. It prints binary equivalent of num.
D. None of the above.

27. Write a program that rotates the number by n number of bits? For example, if binary equivalent of a number is 101011 then after shifting rightmost 3 bits to the left it should become 011101?

28. Write a program to put on alternate bits on of a number starting from leftmost bit which is on. For example, if binary equivalent of a number is 10010100 then after bitwise operations it should change to 10101010.

29. Write a program to invert n bits of a number from position p without disturbing other bits?

30. What will be the output of the following program?

```
#include<stdio.h>
int main( )
{
        char c = 48 ;
        int i, mask = 01 ;
        for ( i=1 ; i<= 5 ; i++ )
        {
                printf( "%c" , c | mask ) ;
                mask= mask<<1 ;
        }
        printf( "\n" ) ;
        return 0 ;
}
```

31. State True or False:
A. Bitwise & and | are unary operators.
B. Bitwise & operator can be used to check if a bit in number is set or not.
C. Bitwise & operator can be used to check if more than one bit in a number is on.
D. Bitwise & operator can be used to divide a number by powers of 2.
E. Bitwise & operator can be used in conjunction with ~ operator to turn off 1 or more bits in a number.
F. Bitwise | operator can be used to set a bit in number.
G. Bitwise | operator can be used to set multiple bits in a number.
H. Bitwise | operator can be used to multiply a number by powers of 2.
I. Bitwise operators can be used to perform addition and subtraction.
J. Bitwise operators can be used to generate a random number.

K. Bitwise operators can be used to reverse sign of a number.

32. What will be the output of the following program?

```
#include<stdio.h>
int main(void)
{
	int x=7,y=19;
	printf("%d  %d  ",x&y,x&&y);
	printf("%d  %d  ",x|y,x||y);
	printf("%d\n",x^y);
	return 0;
}
```

33. What will be the output of the following program?

```
#include<stdio.h>
void displayBits(int x);
int main(void)
{
	unsigned int x,y,z;
	displayBits(0xFFFF);
	x=y=z=0xFFFF;
	x=(x>>5)<<5;	displayBits(x);
	y=(y>>3)<<3;	displayBits(y);
	z=(z>>2)<<2;	displayBits(z);
	return 0;
}
void displayBits(int x)
{
	int i,mask;
	for(i=31; i>=0; i--)
	{
		mask = 1<<i;
		putchar((x & mask)?'1':'0'); /*Test and print ith bit*/
		if(i%8==0)
			putchar(' '); /*Space after 8 bits*/
	}
	printf("\n");
}
```

34. What will be the output of the following program?

```
#include<stdio.h>
int main(void)
{
	int k;
	k=((3<<4)^(96>>1));
	printf("%d\n",k);
	return 0;
}
```

35. What will be the output of the following program?

```
#include<stdio.h>
int main(void)
{
	int x=0x1F;
	x<<2;
	printf("%X  ",x);
	x>>2;
	printf("%X\n",x);
	return 0;
```

```
}
```

36. What will be the output of the following program?

```
#include<stdio.h>
int main(void)
{
  unsigned int arr_mask[]={0x1, 0x2, 0x4, 0x8, 0x10, 0x20, 0x40, 0x80, 0x100, 0x200,
   0x400, 0x800, 0x1000,0x2000, 0x4000, 0x8000, 0x10000, 0x20000, 0x40000, 0x80000,
   0x100000, 0x200000,0x400000, 0x800000, 0x1000000, 0x2000000, 0x4000000, 0x8000000,
   0x10000000, 0x20000000, 0x40000000, 0x80000000};

   int i,x=0x54038F;
        for(i=31; i>=0; i--)
              x&arr_mask[i] ? putchar('1'): putchar('0');
        return 0;
}
```

37. What will be the output of the following program?

```
#include<stdio.h>
int main(void)
{
        unsigned int num=0xA01D,pos=3,bit;
        unsigned int mask=1<<pos;
        bit=(num&mask)>>pos;
        printf("%u\n", bit);
        return 0;
}
```

38. What will be the output of the following program?

```
#include<stdio.h>
int main(void)
{
        unsigned int num=0x1F,pos=3,bit;
        bit=(num>>pos)&1;
        printf("%u\n",bit);
        return 0;
}
```

39. What will be the output of the following program?

```
#include<stdio.h>
int main(void)
{
        int i,num=0xA0DF;
        for(i=31; i>=0; i--)
              printf("%d",(num>>i)&1);
        return 0;
}
```

40. What will be the output of the following program?

```
#include<stdio.h>
int main(void)
{
        int i,num=0x1A3B;
        unsigned int mask=1<<31;
        for(i=31; i>=0; i--)
        {
              (num & mask) ? printf("1") : printf("0");
              mask=mask>>1;
        }
        return 0;}
```

41. What will be the output of the following program?

```
#include<stdio.h>
void func(int x);
int main(void)
{
	func(0x1AE3);
}
void func(int x)
{
	int i,mask;
	mask=1<<31;
	for(i=1; i<=32; i++)
	{
		putchar((x&mask)?'1':'0');
		x<<=1;
		if(i%8==0)
			putchar(' ');
	}
	printf("\n");
	return 0;
}
```

42. What will be the output of the following program?

```
#include<stdio.h>
int func(unsigned int x);
int main(void)
{
	printf("%d\n",func(0x1AE3));
	return 0;
}
int func(unsigned x)
{
	int count=0,mask=1,i;
	for(i=0; i<32; i++)
	{
		if((x&mask)!=0) /*Check ith bit*/
			count++;
		mask<<=1;
	}
	return count;
}
```

43. What will be the output of the following program?

```
#include<stdio.h>
unsigned int func(unsigned int x);
void displayBits(int x);
int main(void)
{
	unsigned int x=0x1AE3;
	displayBits(x);
	x=func(x);
	printf("%X\n",x);
	displayBits(x);
	return 0;
}
unsigned int func(unsigned int num)
{
	unsigned int i,r=0;
	for(i=0; num!=0; i++)
	{
```

```
                r=(r<<1)|num & 1;
                num>>=1;
        }
        r<<=32-i;
        return r;
}
void displayBits(int x)
{
        int i,mask;
        for(i=31; i>=0; i--)
        {
                mask = 1<<i;
                putchar((x & mask)?'1':'0'); /* Test and print ith bit*/
                if(i%8==0)
                        putchar(' '); /*Space after 8 bits*/
        }
        printf("\n");
}
```

44. What will be the output of the following program?

```
#include<stdio.h>
unsigned int func(unsigned int x);
void displayBits(int x);
int main(void)
{
        unsigned int x=0x1AE3;
        displayBits(x);
        x=func(x);
        printf("%X\n",x);
        displayBits(x);
        return 0;
}
unsigned int func(unsigned int num)
{
        unsigned int lmask,rmask,mask;
        lmask=1<<31;
        rmask=1;
        while(lmask > rmask)
        {
                mask=lmask|rmask;
                if((num&mask)!=0 && (num&mask)!=mask)
                        num^=mask;
                lmask>>=1;
                rmask<<=1;
        }
        return num;
}
void displayBits(int x)
{
        int i,mask;
        for(i=31; i>=0; i--)
        {
                mask = 1<<i;
                putchar((x & mask)?'1':'0'); /* Test and print ith bit*/
                if(i%8==0)
                        putchar(' '); /*Space after 8 bits*/
        }
        printf("\n");
}
```

45. What will be the output of the following program?

```
#include<stdio.h>
void displayBits(int x);
int main(void)
{
	unsigned int x=0x123F4;
	displayBits(x);

	printf("(i) Set most significant bit\n");
	x|=(1<<31);	displayBits(x);

	printf("(ii) Clear most significant bit\n");
	x&=~(1<<31);	displayBits(x);

	printf("(iii) Invert all bits\n");
	x^=~0;		displayBits(x);

	printf("(iv) Set all bits\n");
	x|=~0;	displayBits(x);

	printf("(v) Invert least significant byte\n");
	x^=0xFF;  displayBits(x);

	printf("(vi) Invert all bits at even positions 0,2,4,6,8..\n");
	x^=0x55555555;displayBits(x);

	printf("(vii) Invert all bits at odd positions 1,3,5,7,9..\n");
	x^=0xAAAAAAAA;displayBits(x);

	printf("(viii) Clear all bits at even positions 0,2,4,6,8..\n");
	x&=0xAAAAAAAA;displayBits(x);

	printf("(ix) Clear all bits at odd positions 1,3,5,7,9..\n");
	x&=0x55555555;displayBits(x);

	printf("\n\n");
	x=0x123FF;
	displayBits(x);
	printf("(x)Insert 3 trailing zeros \n");
	x=(x>>3)<<3;	displayBits(x);

	printf("(xi) Find if every bit is set \n");
	(x^~0) ? printf("Not all Set\n"): printf("All Set\n");
	(x&~0)==~0 ? printf("All Set\n"): printf("Not all Set\n");

	printf("\n\n");
	x=4;
	printf("x=%d\n",x);
	printf("(xii) Multiply by 7\n");
	x=(x<<3)-x;
	printf("x=%d\n",x);

	printf("(xiii) Multiply by 9\n");
	x=(x<<3)+x;
	printf("x=%d\n",x);

	printf("(xiv) Multiply by 3.5\n");
	x=((x<<3)-x)>>1;
	printf("x=%d\n",x);
	return 0;
```

```
}
void displayBits(int x)
{
	int i,mask;
	for(i=31; i>=0; i--)
	{
		mask = 1<<i;
		putchar((x & mask)?'1':'0'); /* Test and print ith bit*/
		if(i%8==0)
			putchar(' '); /*Space after 8 bits*/
	}
	printf("\n");
}
```

46. What will be the output of the following program?

```
#include<stdio.h>
int wordlength(void);
int main(void)
{
	printf("%d  ",wordlength());
	return 0;
}
int wordlength(void)
{
	unsigned x;
	int count=0;
	for(x=~0; x!=0; x=x<<1)
		count++;
	return count;
}
```

47. What will be the output of the following program?

```
#include<stdio.h>
int main(void)
{
	unsigned x=1434,y=32,r;
	r=x&(y-1);
	printf("%d  %d",x%y,r);
	return 0;
}
```

48. What will be the output of the following program?

```
#include<stdio.h>
int isMultiple(int x,int n);
int main(void)
{
	int x,i;
	printf("Enter x and i : ");
	scanf("%d%d",&x,&i);
	if(isMultiple(x,i) )
		printf("%d is multiple of 2 to the power of %d\n",x,i);
	else
		printf("%d is not multiple of 2 to the power of %d\n",x,i);
	return 0;
}
int isMultiple(int x,int i)
{
	return !(x & (~(~0<<i)));
}
```

49. What will be the output of the following program?

```
#include<stdio.h>
void displayBits(int x);
int count_setbits2(unsigned x);
int main(void)
{
	unsigned x=1034,y=1083;
	displayBits(x);
	displayBits(y);
	printf("%d\n",count_setbits2(x^y));
	return 0;
}
int count_setbits2(unsigned x)
{
	int count=0;
	while(x!=0)
	{
		count++;
		x=x&(x-1);
	}
	return count;
}
void displayBits(int x)
{
	int i,mask;
	for(i=31; i>=0; i--)
	{
		mask=1<<i;
		putchar((x & mask)?'1':'0'); /* Test and print ith bit*/
		if(i%8==0)
			putchar(' '); /*Space after 8 bits*/
	}
	printf("\n");
}
```

50. What will be the output of the following program?

```
#include<stdio.h>
void displayBits(int x);
int main(void)
{
	int count,x=0x1F,y=0xF1,z;
	displayBits(x);
	displayBits(y);
	count=0;
	for(z=x^y; z!=0; z=z&(z-1))
		count++;
	printf("%d\n",count);

	count=0;
	for(z=x^y; z!=0; z>>=1)
		count+=z&1;
	printf("%d\n",count);
	return 0;
}

void displayBits(int x)
{
	int i,mask;
	for(i=31; i>=0; i--)
	{
```

```
                mask = 1<<i;
                putchar((x & mask)?'1':'0'); /* Test and print ith bit*/
                if(i%8==0)
                        putchar(' '); /*Space after 8 bits*/
        }
        printf("\n");
}
```

51. What will be the output of the following program?

```
#include<stdio.h>
void displayBits(int x);
#include<math.h>
int main(void)
{
        int mask,p=7,n=4,x=103145;

        displayBits(x);
        if(n<0)
                mask = ~(~(~0<<abs(n))<<p);
        else
    mask = ~(~(~0<<n)<<p-n+1);
        displayBits(mask);
        x=x&mask;
        displayBits(x);

        p=7,n=-4,x=103145;
        displayBits(x);
        if(n<0)
                mask = ~(~(~0<<abs(n))<<p);
        else
    mask = ~(~(~0<<n)<<p-n+1);
        displayBits(mask);
        x=x&mask;
        displayBits(x);
        return 0;
}
void displayBits(int x)
{
        int i,mask;
        for(i=31; i>=0; i--)
        {
                mask = 1<<i;
                putchar((x & mask)?'1':'0'); /* Test and print ith bit*/
                if(i%8==0)
                        putchar(' '); /*Space after 8 bits*/
        }
        printf("\n");
}
```

52. What will be the output of the following program?

```
#include<stdio.h>
void displayBits(int x);
int main(void)
{
        unsigned int x=103145, p=7, n=5;
        displayBits(x);
        x=func(x,p,n);
        displayBits(x);
        return 0;
}
```

```
unsigned int func(unsigned int x, int p, int n)
{
	return  (x>>(p+1-n)) & ~(~0<<n) ;
}
void displayBits(int x)
{
	int i,mask;
	for(i=31; i>=0; i--)
	{
		mask = 1<<i;
		putchar((x & mask)?'1':'0'); /* Test and print ith bit*/
		if(i%8==0)
			putchar(' '); /*Space after 8 bits*/
	}
	printf("\n");
}
```

53. What will be the output of the following program?

```
#include<stdio.h>
void displayBits(int x);
int main(void)
{
	unsigned x,y,r,mask,i=9;

	x=0x123;
	y=0xffffff;
	mask=~0<<i+1;
	r=(x&~mask) | (y&mask);
	displayBits(x);
	displayBits(y);
	displayBits(r);
	return 0;
}
void displayBits(int x)
{
	int i,mask;
	for(i=31; i>=0; i--)
	{
		mask = 1<<i;
		putchar((x & mask)?'1':'0'); /* Test and print ith bit*/
		if(i%8==0)
			putchar(' '); /*Space after 8 bits*/
	}
	printf("\n");
}
```

54. What will be the output of the following program?

```
#include<stdio.h>
void displayBits(int x);
unsigned clear(unsigned x,int i,int j);
int main(void)
{
	unsigned x = 0x23173b4;
	displayBits(x);
	x = clear(x,3,7) ;
	displayBits(x);
	return 0;
}
unsigned clear(unsigned x,int i,int j)
{
```

```
	unsigned mask = ~0<<(j+1) | (1<<i)-1;
	return x&mask;
}

void displayBits(int x)
{
	int i,mask;
	for(i=31; i>=0; i--)
	{
		mask = 1<<i;
		putchar((x & mask)?'1':'0'); /* Test and print ith bit*/
		if(i%8==0)
			putchar(' '); /*Space after 8 bits*/
	}
	printf("\n");
}
```

55. What will be the output of the following program?

```
#include<stdio.h>
unsigned set(int x,int i,int j);
void displayBits(int x);
int main(void)
{
	unsigned x=0x23172b0;
	displayBits(x);
	x=set(x,3,7);
	displayBits(x);
	return 0;
}
unsigned set(int x,int i,int j)
{
   int mask=0,p;
	for(p=i; p<j; p++)
		mask=mask | 1<<p;
	return x|mask;
}
void displayBits(int x)
{
	int i,mask;
	for(i=31; i>=0; i--)
	{
		mask = 1<<i;
		putchar((x & mask)?'1':'0'); /* Test and print ith bit*/
		if(i%8==0)
			putchar(' '); /*Space after 8 bits*/
	}
	printf("\n");
}
```

56. What will be the output of the following program?

```
#include<stdio.h>
int main(void)
{
	int x=511;
	if((x&(x+1))==0)
		printf("Yes\n");
	else
		printf("No\n");
	return 0;
}
```

57. What will be the output of the following program?

```
#include<stdio.h>
int main(void)
{
	int x=511;
	if((x&(x+1))==0)
		printf("Yes\n");
	else
		printf("No\n");
	return 0;
}
```

58. What will be the output of the following program?

```
#include<stdio.h>
int main(void)
{
	int x=245;
	x=-(~x);
	printf("%d\t", x);
	x=~(-x);
	printf("%d\n", x);
	return 0;
}
```

59. What will be the output of the following program?

```
#include<stdio.h>
void displayBits(int x);
int main(void)
{
	int x=0x12E8;
	displayBits(x);
	x = x & ~(x-1);
	displayBits(x);

	x=0x12E8;
	displayBits(x);
	x = x & -x; /*in two's complement machine*/
	displayBits(x);
	return 0;
}
void displayBits(int x)
{
	int i,mask;
	for(i=31; i>=0; i--)
	{
		mask = 1<<i;
		putchar((x & mask)?'1':'0'); /* Test and print ith bit*/
		if(i%8==0)
			putchar(' '); /*Space after 8 bits*/
	}
	printf("\n");
}
```

60. What will be the output of the following program?

```
#include<stdio.h>
#include<math.h>
unsigned func(unsigned int n);
unsigned func1(unsigned int n);
int main(void)
```

```
{
        unsigned x=8;
   printf("%d %d\n",func(x), func1(x));
        x=35;
        printf("%d %d\n",func(x), func1(x));
        return 0;
}
unsigned func(unsigned int n)
{
        int count=0;
        while(n!=0)
        {
                n>>=1;
                count++;
        }
        return count-1;
}
unsigned func1(unsigned int n)
{
        return log(n)/log(2);
}
```

61. What will be the output of the following program?

```
#include<stdio.h>
void displayBits(int x);
unsigned parity(int x);
int main(void)
{
        unsigned int n=67;
        displayBits(n);
        printf("%d\n",parity(n));
        return 0;
}
unsigned parity(int x)
{
   unsigned parity=0;
        while(x)
        {
                parity=!parity;
                x=x&(x-1);
        }
        return parity;
}
void displayBits(int x)
{
        int i,mask;
        for(i=31; i>=0; i--)
        {
                mask = 1<<i;
                putchar((x & mask)?'1':'0'); /* Test and print ith bit*/
                if(i%8==0)
                        putchar(' '); /*Space after 8 bits*/
        }
        printf("\n");
}
```

62. What will be the output of the following program?

```
 #include<stdio.h>
unsigned mult(unsigned int x,unsigned int y);
int main(void)
```

```
{
        printf("%d\n",mult(9,8));
        return 0;
}
unsigned mult(unsigned int x,unsigned int y)
{
        unsigned z=0;
        while(y!=0)
        {
                if((y&1)!=0)
                        z=z+x;
                x<<=1;
                y>>=1;
        }
        return z;
}
```

63. What will be the output of the following program?

```
#include<stdio.h>
int main(void)
{
        unsigned num=0xf000000f;
        printf("%d\n",count1(num));
        printf("%d\n",count2(num));
        printf("%d\n",count3(num));
        printf("%d\n",count4(num));
        return 0;
}
int count1(unsigned x)
{
        int count=0;
        while(x!=0)
        {
                count++;
                x=x&(x-1);
        }
        return count;
}
int count2(int x)
{
        return 32-count1(x);
}
int count3(int x)
{
        return count1(~x);
}
int count4(int x)
{
   int c=0;
   for(x=~x; x!=0; x=x&(x-1))
                c++;
        return c;
}
```

64. What will be the output of the following program?

```
#include<stdio.h>
void swap(int *a,int *b);
void swap1(int *a,int *b);
int main(void)
{
```

```
	int x=2,y=2;
	int arr[5]={1,2,5,3,4},i,j,n=5,min;
	for(i=0; i<n-1; i++)
	{
		min=i;
		for(j=i+1; j<n; j++)
		{
			if(arr[min]>arr[j])
				min=j ;
		}
		swap(&arr[i],&arr[min]);
		/*swap1(&arr[i],&arr[min]);*/
	}
	printf("Sorted list is : \n");
	for(i=0; i<n; i++)
		printf("%d ",arr[i]);
	printf("\n");
	return 0;
}
void swap(int *a,int *b)
{
	int temp;
	temp=*a;
	*a=*b;
	*b=temp;
}
void swap1(int *x,int *y)
{
	*x = *x ^ *y;
	*y = *x ^ *y;
	*x = *x ^ *y;
}
```

65. What will be the output of the following program?

```
#include<stdio.h>
void displayBits(int x);
int main(void)
{
	unsigned n=123456;
	displayBits(n);
	n=n|(n-1);
	displayBits(n);
	return 0;
}
void displayBits(int x)
{
	int i,mask;
	for(i=31; i>=0; i--)
	{
		mask = 1<<i;
		putchar((x & mask)?'1':'0'); /* Test and print ith bit*/
		if(i%8==0)
			putchar(' '); /*Space after 8 bits*/
	}
	printf("\n");
}
```

66. What will be the output of the following program?

```
#include<stdio.h>
void displayBits(int x);
```

```
int main(void)
{
        unsigned n=0x1000010;
   displayBits(n);
        n|=n>>1;
        n|=n>>2;
        n|=n>>4;
        n|=n>>8;
        n|=n>>16;
        displayBits(n);
        return 0;
}
void displayBits(int x)
{
        int i,mask;
        for(i=31; i>=0; i--)
        {
                mask = 1<<i;
                putchar((x & mask)?'1':'0'); /* Test and print ith bit*/
                if(i%8==0)
                        putchar(' '); /*Space after 8 bits*/
        }
        printf("\n");
}
```

67. What will be the output of the following program?

```
#include<stdio.h>
void displayBits(int x);
unsigned nextHighestPow2(unsigned int n);
int main(void)
{
        unsigned n=250,x;
   displayBits(n);
        x=nextHighestPow2(n);
        displayBits(x);
        printf("%d\n",x);
        return 0;
}
unsigned nextHighestPow2(unsigned int n)
{
        n--;
        n|=n>>1;
        n|=n>>2;
        n|=n>>4;
        n|=n>>8;
        n|=n>>16;
        n++;
        return n;
}
void displayBits(int x)
{
        int i,mask;
        for(i=31; i>=0; i--)
        {
                mask = 1<<i;
                putchar((x & mask)?'1':'0'); /* Test and print ith bit*/
                if(i%8==0)
                        putchar(' '); /*Space after 8 bits*/
        }
        printf("\n");
```

```
}
```

68. What will be the output of the following program?

```
#include<stdio.h>
int leadingZeros(int x);
int count_setbits(x);
int rightProp(int n);
int main(void)
{
	int x=0xFF;
	printf("%d\n",leadingZeros(x));
	return 0;
}
int leadingZeros(int x)
{
	x=rightProp(x);
	return count_setbits(~x);
}
int rightProp(int n)
{
   n|=n>>1;
	n|=n>>2;
	n|=n>>4;
	n|=n>>8;
	n|=n>>16;
	return n;
}
int count_setbits(int x)
{
	int count=0;
	while(x!=0)
	{
		count++;
		x=x&(x-1);
	}
	return count;
}
```

69. What will be the output of the following program?

```
#include<stdio.h>
void displayBits(int x);
int func(int x);
int main(void)
{
	int x=0x123;
	displayBits(x);
	x=func(x);
	displayBits(x);
	return 0;
}
int func(int x)
{
   return x|(x+1);
}
void displayBits(int x)
{
	int i,mask;
	for(i=31; i>=0; i--)
	{
		mask = 1<<i;
```

```
                putchar((x & mask)?'1':'0'); /*Test and print ith bit*/
                if(i%8==0)
                        putchar(' '); /*Space after 8 bits*/
        }
        printf("\n");
}
```

70. What will be the output of the following program?

```
#include<stdio.h>
void displayBits(int x);
int main(void)
{
        unsigned x=0x12E;
        displayBits(x);
        displayBits(swap(x));
        return 0;
}
unsigned int swap(unsigned int x)
{
        return ((x & 0x55555555)<<1) | ((x & 0xAAAAAAAA)>>1);
}
void displayBits(int x)
{
        int i,mask;
        for(i=31; i>=0; i--)
        {
                mask = 1<<i;
                putchar((x & mask)?'1':'0'); /* Test and print ith bit*/
                if(i%8==0)
                        putchar(' '); /*Space after 8 bits*/
        }
        printf("\n");
}
```

71. What will be the output of the following program?

```
#include<stdio.h>
void displayBits(int x);
unsigned swap4Bits(int x);
int main(void)
{
        unsigned x=0x15F93A7;
        displayBits(x);
        displayBits(swap4Bits(x));
        return 0;
}
unsigned swap4Bits(int x)
{
        return ((x & 0x0F0F0F0F)<<4) | ((x & 0xF0F0F0F0)>>4);
}
void displayBits(int x)
{
        int i,mask;
        for(i=31; i>=0; i--)
        {
                mask = 1<<i;
                putchar((x & mask)?'1':'0'); /* Test and print ith bit*/
                if(i%8==0)
                        putchar(' '); /*Space after 8 bits*/
        }
        printf("\n");
```

```
}
```

72. What will be the output of the following program?

```
#include<stdio.h>
void displayBits(int x);
unsigned swapBytes(unsigned x);
int main(void)
{
	unsigned x = 0x15F93A7;
	displayBits(x);
	displayBits(swapBytes(x));
	return 0;
}
unsigned swapBytes(unsigned x)
{
	return ((x & 0x00ff00ff) << 8) | ((x & 0xff00ff00) >> 8);
}
void displayBits(int x)
{
	int i,mask;
	for(i=31; i>=0; i--)
	{
		mask = 1<<i;
		putchar((x & mask)?'1':'0'); /* Test and print ith bit*/
		if(i%8==0)
			putchar(' '); /*Space after 8 bits*/
	}
	printf("\n");
}
```

73. What will be the output of the following program?

```
#include<stdio.h>
void displayBits(int a);
unsigned reverseBytes(unsigned x);
int main(void)
{
	unsigned x = 0xFA12CD04;
	displayBits(x);
	displayBits(reverseBytes(x));
	return 0;
}
unsigned reverseBytes(unsigned x)
{
	return (x>>24) | ((x & 0xFF0000)>>8) | ((x & 0xFF00)<<8) | (x<<24);
}
void displayBits(int x)
{
	int i,mask;
	for(i=31; i>=0; i--)
	{
		mask = 1<<i;
		putchar((x & mask)?'1':'0'); /* Test and print ith bit*/
		if(i%8==0)
			putchar(' '); /*Space after 8 bits*/
	}
	printf("\n");
}
```

74. What will be the output of the following program?

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

```
void displayBits(int a);
unsigned func(int x);
int main(void)
{
	unsigned x=0xFA2E4;
	displayBits(x);
	displayBits(func(x));
	return 0;
}
unsigned func(int x)
{
	x = ((x&0x55555555) << 1) | ((x&0xaaaaaaaa) >> 1);
	x = ((x&0x33333333) << 2) | ((x&0xcccccccc) >> 2);
	x = ((x&0x0f0f0f0f) << 4) | ((x&0xf0f0f0f0) >> 4);
	x = ((x&0x00ff00ff) << 8) | ((x&0xff00ff00) >> 8);
	x = ((x&0x0000ffff) << 16)  | ((x&0xffff0000) >> 16);
	return x;
}
void displayBits(int x)
{
	int i,mask;
	for(i=31; i>=0; i--)
	{
		mask = 1<<i;
		putchar((x & mask)?'1':'0'); /*Test and print ith bit*/
		if(i%8==0)
			putchar(' '); /*Space after 8 bits*/
	}
	printf("\n");
}
```

75. What will be the output of the following program?

```
#include<stdio.h>
void displayBits(int a);
unsigned func(unsigned x);
int main(void)
{
	unsigned x=12345678;
	displayBits(x);
	displayBits(func(x));
	printf("%d\n",func(x));
	return 0;
}
unsigned func(unsigned x)
{
	x = (x & 0x55555555) + ((x & 0xaaaaaaaa) >> 1);
	x = (x & 0x33333333) + ((x & 0xcccccccc) >> 2);
	x = (x & 0x0f0f0f0f) + ((x & 0xf0f0f0f0) >> 4);
	x = (x & 0x00ff00ff) + ((x & 0xff00ff00) >> 8);
	x = (x & 0x0000ffff) + ((x & 0xffff0000) >> 16);
	return x;
}
void displayBits(int x)
{
	int i,mask;
	for(i=31; i>=0; i--)
	{
		mask = 1<<i;
		putchar((x & mask)?'1':'0'); /*Test and print ith bit*/
		if(i%8==0)
```

```
                        putchar(' '); /*Space after 8 bits*/
        }
        printf("\n");
}
```

76. What will be the output of the following program?

```
#include<stdio.h>
void displayBits(int x);
int pack(int empid, int jobid, char jstatus, char gender, int age, char mstatus);
int main(void)
{
        int emp;
        int empid,jobid,age,mstatus;
        char gender,jstatus;
        emp=pack(2048,80,'P','F',50,3);
        displayBits(emp);
        /*Unpack*/
        empid = emp & 0xFFF;
        jobid = (emp & 0x7F000)>>12;
        jstatus = (emp & 0x80000)>>19;
        gender = (emp & 0x100000)>>20;
        age =  (emp & 0xFE00000)>>21;
        mstatus = (emp & 0x30000000)>>28;
        printf("%d\n%d\n%d\n%d\n%d\n%d\n",empid,jobid,jstatus,gender,age,mstatus);
        return 0;
}
int pack(int empid, int jobid, char jstatus, char gender, int age, char mstatus)
{
        int emp=0;
        emp = emp | empid;
        emp = emp | jobid<<12;
        emp = emp | (jstatus == 'T' ? 0 : 1)<<19;
        emp = emp | (gender == 'F' ? 0 : 1)<<20;
        emp = emp | age<<21;
        emp = emp | mstatus<<28;
        return emp;
}
void displayBits(int x)
{
        int i,mask;
        for(i=31; i>=0; i--)
        {
                mask = 1<<i;
                putchar((x & mask)?'1':'0'); /* Test and print ith bit*/
                if(i%8==0)
                        putchar(' '); /*Space after 8 bits*/
        }
        printf("\n");
}
```

77. What will be the output of the following program?

```
#include<stdio.h>
void displayBits(int x);
int convertToBCD(int n);
int convertToBinary(int bcd);
int main(void)
{
        int bcd,bin;

        printf("Enter a number :");
```

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

	displayBits(bin);
	bcd=convertToBCD(bin);

	displayBits(bcd);
	bin=convertToBinary(bcd);

	displayBits(bin);
	return 0;
}

int convertToBCD(int n)
{
	int rem,i,bcd=0;
	for(i=0; n>0; i++)
	{
		rem=n%10;	/*taking last digit of number*/
		bcd = bcd | ( (rem & 0xF)<< i*4 );
		n/=10;		/*skipping last digit*/
	}
	return bcd;
}

int convertToBinary(int bcd)
{
	int i,bin=0,d=1;
	for(i=0; i<32; i+=4)
	{
		bin+=d*(bcd>>i & 0xF);
		d*=10;
}
	return bin;
}

void displayBits(int x)
{
	int i,mask;
	for(i=31; i>=0; i--)
	{
		mask = 1<<i;
		putchar((x & mask)?'1':'0'); /* Test and print ith bit*/
		if(i%8==0)
			putchar(' '); /*Space after 8 bits*/
	}
	printf("\n");
}
```

78. What will be the output of the following program?

```
#include<stdio.h>
char unpack(int n, int p);
unsigned pack_chars1(char c1,char c2,char c3,char c4);
unsigned pack_chars2(char c1,char c2,char c3,char c4);
int main(void)
{
	int p1,p2;
	p1 = pack_chars1('p','q','r','s');
	p2 = pack_chars2('p','q','r','s');
	printf("%c %c %c %c\n",unpack(p1,0),unpack(p1,1), unpack(p1,2), unpack(p1,3));
	printf("%c %c %c %c\n",unpack(p2,0),unpack(p2,1), unpack(p2,2), unpack(p2,3));
```

```
	return 0;
}
unsigned pack_chars1(char c1,char c2,char c3,char c4)
{
	int n;
	n = c1;
	n = n | c2<<8;
	n = n | c3<<16;
	n = n | c4<<24;
	return n;
}
unsigned pack_chars2(char c1,char c2,char c3,char c4)
{
	int n;
	n = c1;
	n = (n<<8) | c2;
	n = (n<<8) | c3;
	n = (n<<8) | c4;
	return n;
}
char unpack(int n, int p)
{
	unsigned mask = 0xFF << p*8;
	return  (n & mask)>>p*8;
}
```