

Solution/Model Answer to IAT-1

C programming for problem Solving –
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Q1) Describe the various type of computer (according to purpose and according to size and speed) 10

Generation	Duration	Devices	Purpose	Size & Speed	Examples
First	1940-50	Vacuum Tubes & Plug boards	General Purpose Electromechanical Systems	Huge & Very Slow	ENIAC, UNIVAC-I
Second	1950-60	Transistors/Semiconductors	Batch processing, Punched cards, Magnetic Tape	Little Big & slow	IBM 1401, MARK-III, UNIVAC 1107
Third	1960-70	IC(Integrated Circuits)	Parallel Processing, OS to manage Hardware, software & resources	Smaller & faster, Storage devices	IBM 360
Fourth	1970 onwards	LSI (Large Scale Integration)	GUI, Microprocessor, Networks & Internet	Small & very fast, Large storage capacity in MB	Intel C4004, 8085, 8086, 80386 & 80486 Desktop PCs, Main Frame & Super computers
	Going on	VLSI	GUI & Network OS Ubuntu, , Android	Very small but Very-very Faster, Storage in Terabytes	Pentium I, II, III, IV, Dual core Laptops, Tablets, Smart Phones

According to purpose:

- a. **Analog computers:** Analog computer is a form of computer that is used to read & measure the physical phenomena such as electrical, mechanical, or hydraulic quantities **(Not discrete)** . Eg. Thermometer, Speedometer, Morse code Telex Machine, amplifiers

etc.

- b. **Digital Computer:** A computer that performs calculations and logical operations with quantities represented as digits, usually in the binary number system. Example: Calculator, laptops, PCS
- c. **Hybrid Computer:** A combination of analog and digital computers those are capable of inputting and outputting in both digital and analog signals. A hybrid computer system setup offers a cost effective method of performing complex simulations. **Here calculations are done digitally and**

actions are taken mechanically or vice-versa. Super computers and robots are hybrid computers.

According to size:

- a. Super Computer: They are very large and very fast & task specific computers used by large organizations. These computers are used for **weather forecasting, meteorology, earth-quack studies, research and exploration** purposes. Super computers may be installed in satellites. NASA uses supercomputers for launching space shuttles, controlling them and for space exploration purpose. Example: **Titan, Cray(of India)**
- b. Mainframe Computer: These are smaller and less faster than super computers. Large firms & government organizations like banks, railways use Mainframes to run their business operations in their head/central office as a central role to update day to day transactions. Using virtual machines, mainframes run the various operating systems as if they were running on different computers. Example z9, z10
- c. Mini Computers: Minicomputers are used by small businesses & firms. Minicomputers are also called as "Midrange Computers". Individual departments of a large company or organizations use Mini-computers for specific purposes. Example K202, IBM Midrange
- d. Micro Computers: Desktop computers, **laptops, PCs, personal digital assistant (PDA), tablets & Smartphones, Scientific Ciculators, Notebook, Gaming console, Sound and navigation System** are all types of microcomputers. The micro-computers are widely used & the fastest growing computers. Well known manufacturers are Dell, Apple, Samsung, Sony etc.

2) a) Define the terms Network, LAN, WAN & MAN. [5]

b) Differentiate between Primary Memory and Secondary Memory [5]

The **Network** allows computers to **connect and communicate** with different computers via any medium. LAN, MAN and WAN are the three major types of the network designed to operate over the area they cover. There are some similarities and dissimilarities between them. One of the major differences is the geographical area they cover, i.e. **LAN** covers the smallest area; **MAN** covers an area larger than LAN and **WAN** comprises the largest of all.

Local Area Network (LAN): LAN or Local Area Network connects network devices in such a way that personal computer and workstations can share data, tools and programs. The group of computers and devices are connected together by a switch, or stack of switches, using a private addressing scheme as defined by the TCP/IP protocol. Private addresses are unique in relation to

other computers on the local network. Routers are found at the boundary of a LAN, connecting them to the larger WAN.

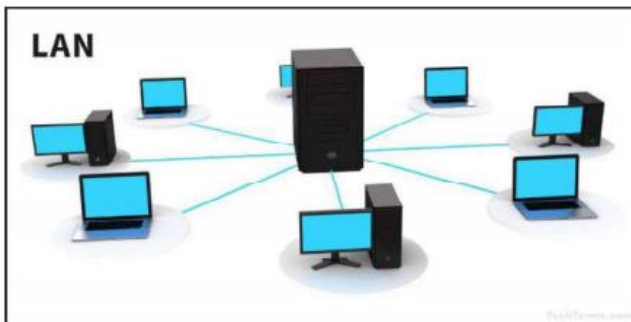
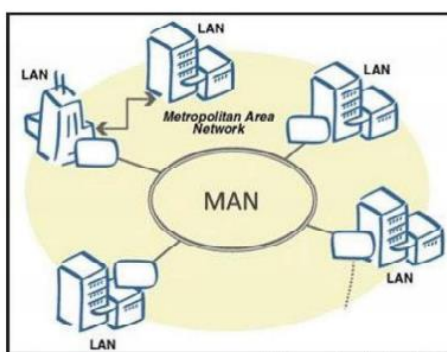


Fig. 1.15: Local Area Network

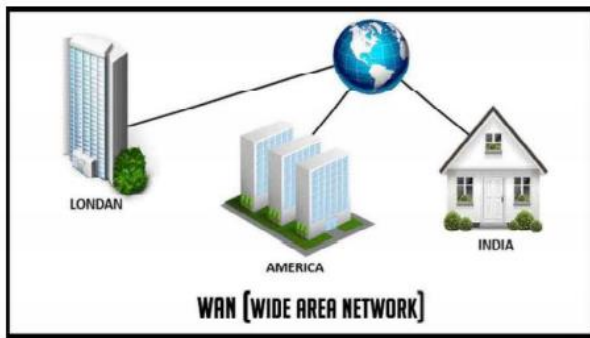
Metropolitan Area Network (MAN): MAN or Metropolitan area Network covers a larger area than that of a LAN and smaller area as compared to WAN. It connects two or more computers that are apart but resides in the same or different cities. It covers a large geographical area and may serve as an ISP (Internet Service Provider). MAN is designed for customers who need a high-speed connectivity. Speeds of MAN ranges in terms of Mbps. It's hard to design and maintain a Metropolitan Area Network.

The fault tolerance of a MAN is less and also there is more congestion in the network. It is costly and may or may not be owned by a single organization. The data transfer rate and the propagation delay of MAN is moderate. Devices used for transmission of data through MAN are: Modem and Wire/Cable. Examples of a MAN are the part of the telephone company network that can provide a high-speed DSL line to the customer or the cable TV network in a city.



Wide Area Network (WAN): WAN or Wide Area Network is a computer network that extends over a large geographical area, although it might be confined within the bounds of a state or country. A WAN could be a connection of LAN connecting to other LAN's via telephone lines and radio waves and may be limited to an enterprise (a corporation or an organization) or accessible to the public. The technology is high speed and relatively expensive.

There are two types of WAN: Switched WAN and Point-to-Point WAN. WAN is difficult to design and maintain. Similar to a MAN, the fault tolerance of a WAN is less and there is more congestion in the network. A Communication medium used for WAN is PSTN or Satellite Link. Due to long distance transmission, the noise and error tend to be more in WAN.



b)

Parameter	Primary memory	Secondary memory
Nature	The primary memory is categorized as volatile & nonvolatile memories.	The secondary memory is always a non-volatile memory.
Alias	These memories are also called internal memory.	Secondary memory is known as a Backup memory or Additional memory or Auxiliary memory.
Access	Data is directly accessed by the processing unit.	Data cannot be accessed directly by the processor. It is first copied from secondary memory to primary memory. Only then CPU can access it.
Formation	It's a volatile memory meaning data cannot be retained in case of power failure.	It's a non-volatile memory so that that data can be retained even after power failure.
Storage	It holds data or information that is currently being used by the processing unit. Capacity is usually in 16 to 32 GB	It stores a substantial amount of data and information. Capacity is generally from 200GB to terabytes.
Accesses	Primary memory can be accessed by the data bus.	Secondary memory is accessed by I/O channels.
Expense	Primary memory is costlier than secondary memory.	Secondary memory is cheaper than primary memory.

3) Solve the followings:

[3+4+3]

a) If integers $a = 4$, $b = 2$, $x=2$, $y=3$ $a=(x/y)+a/b$; $b=(a*x)/y$; $x=a-b$; then what will be values of a , b and x

b) Output of the code: `int main() { int i = 8, j=5; char c='c', d='d'; printf("%d", (3*i-2*j) % (2*d-c)); printf("%d", 2* ((i/5) + (4 *(j-3)) % (i+j -2))); return (0); }`

c) Convert the following math expressions to equivalent C statements


i) $m = x^4 + \sqrt{x + \frac{y}{k}} - 4x + 6$

ii) $x = \frac{-b + \sqrt{b^2 - 4ac}}{2a}$

iii) $\text{Area} = \pi r^2 + 2\pi rh$

a) $a = (x/y)+a/b = (2/3) + (4/2) = 0+2 = 2$
 $b = (a*x)/y = (2*2)/3 = 1$
 $x = a - b = 2 - 1 = 1$

```
21 /*a)*/ int a=4, b=2, x=2,
    y=3;
22 a=(x/y)+a/b;
23 b=(a*x)/y;
24 x=a-b;
25 printf("\n%d %d %d",a,b,x);
26
27
28
```



b)

```
int i = 8, j=5; char c='c', d='d';
printf("\n%d", (3*i-2*j) % (2*d-c));
printf("\n%d", 2* ((i/5) + (4 *(j-3)) % (i+j -2)));
```



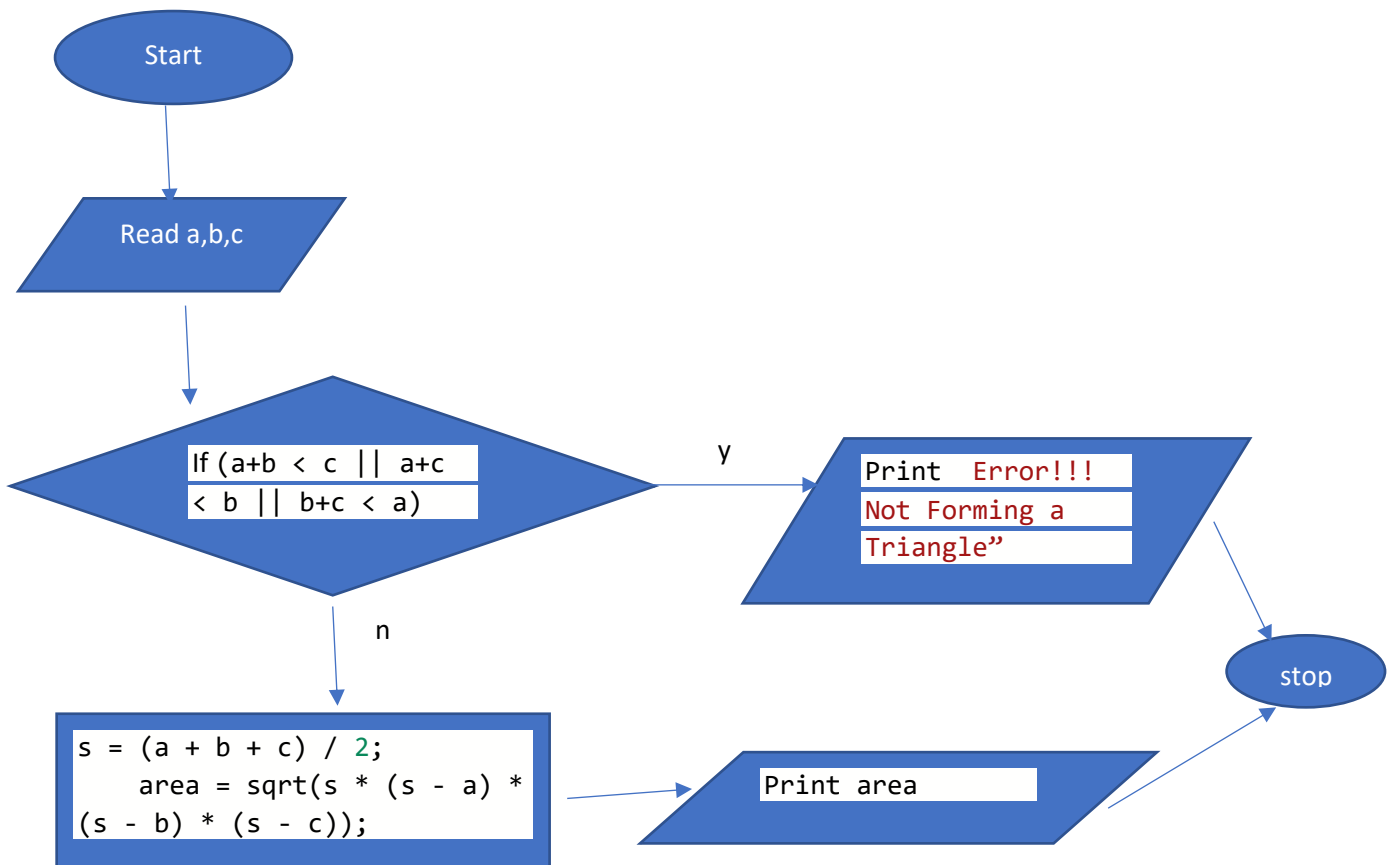
c) $m = \text{pow}(x,4) + \text{sqrt}(x + y/k) - 4*x + 6$
 $x = (-b + \text{sqrt}(b*b-4*a*c)) / (2*a)$
 $\text{Area} = 3.14 * r*r + 2*3.14*r*h$

4 . Write algorithm or flow chart with a C program to find area of a triangle by given 3 sides. These should generate error if sum of two sides are not greater than third side. [10]

```
1
2 #include<stdio.h>
3 #include<math.h>
4 int main()
5 {
6     int s, a, b, c, area;
7
8     printf("Enter the values of a, b and c \n");
9     scanf("%d %d %d", &a, &b, &c);
10    if(a+b < c || a+c < b || b+c < a)
11    {
12        printf("\nError!!! Not Forming a Triangle");
13        return 0;
14    }
15    s = (a + b + c) / 2;
16    area = sqrt(s * (s - a) * (s - b) * (s - c));
17    printf("Area of a triangle = %d \n", area);
18    return 0;
19 }
```

```
> cc tri.c -lm
> ./a.out
Enter the values of a, b and c
1
2
6

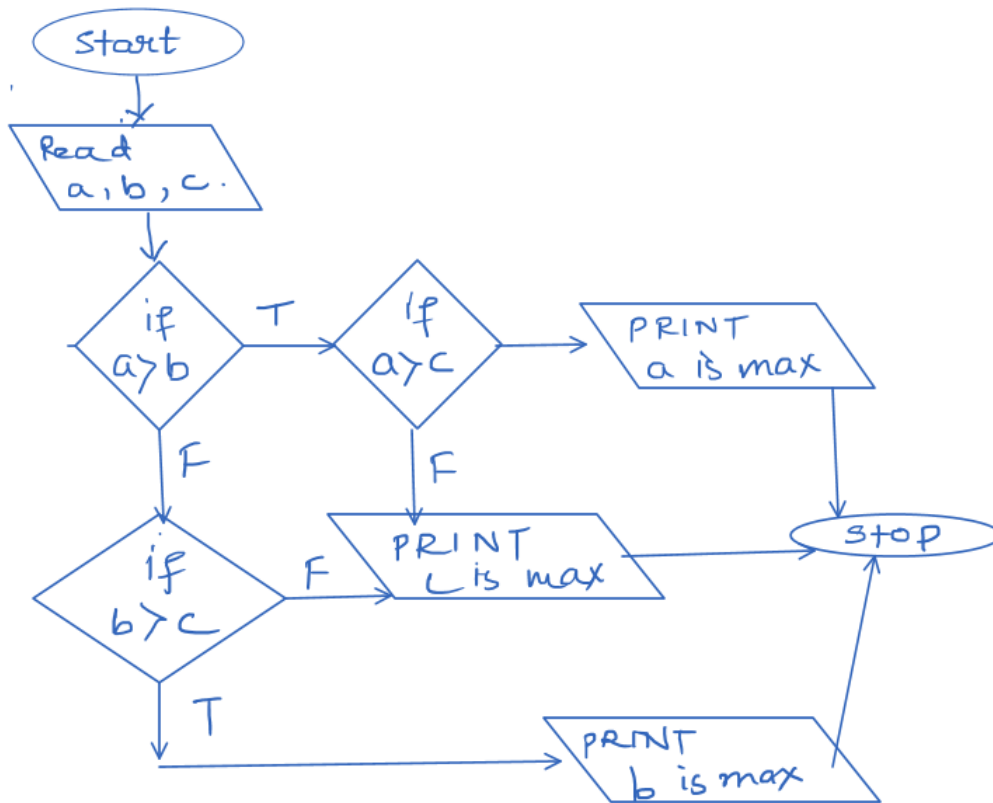
Error!!! Not Forming a Triangle: ./a.out
Enter the values of a, b and c
12
10
8
Area of a triangle = 39
>
```



5 Drawing a flow chart write a C program to find maximum in 3 numbers using nested if structure.
10

```

#include<stdio.h>
int main(void){
    int a,b,c;
    printf("Enter the values");
    scanf("%d%d%d",&a,&b,&c);
    if(a>b) {
        if(a>c)
            printf("\n a is greatest");
        else
            printf("\n c is greatest");
    }
    else{
        if(b>c)
            printf("\n b is greatest");
        else
            printf("\n c is greatest");
    }
    return 0;
}
  
```



6) a) Explain Bitwise ~ (compliment) and Bitwise ^ (XOR) operators of C with example

b) Write the output of following statement

assuming integers $n1 = 4$ and $n2 = 5$. 1. `printf("%d", n1 & n2);` 2. `printf("%d", n1 | n2);` 3. `printf("%d", n1 & 1);` 4. `printf("%d", n2 | 0);` 5. `printf("%d", n1 >> n2);` 6. `printf("%d", n1 << n2);`

a) ^ - Bit wise XOR (Exclusive or): 1 when only one input is 1. If both are 1 or 0, it gives 0

`printf("%d", 20 ^ 25);` /*10100 ^ 11001 = 01101 will give output 13*/

~ - Bit-wise compliment : Difference in highest & given. In Binary 1 will be 0 and 0 will be 1. If unsigned int has 2 bytes (16 bits) size with highest value 65535 then `printf("%u", ~ 5);` /*~ 00000000000000101 = 1111111111111010 will give output 65530*/

```

#include<stdio.h>
int main(){
int n1 = 4, n2 = 5;
| printf("\n%d", n1 & n2);
printf("\n%d", n1 | n2);
printf("\n%d", n1 & 1);
printf("\n%d", n2 | 0);
printf("\n%d", n1 >> n2);
printf("\n%d", n1 << n2);
}
  
```

```

clang version 7.0.0
al)
cc IAT.c
./a.out

4
5
0
5
0
128
  
```

b) |

7 Explain type casting. What happens when one tries to store a real number in a variable of type integer? What is the difference between implicit and explicit type conversion. Example with example. 10

Type conversion concept in C language is used to modify a variable from one data type to another data type. New data type should be mentioned before the variable name or value in brackets which to be typecast.

Example:

```
result = (float) 20/3;
```

- It is best practice to convert lower data type to higher data type to avoid data loss.
- Data will be truncated when higher data type is converted to lower. For example, if float is converted to int, data which is present after decimal point will be lost

Type conversion can be done 2ways:

a) Implicit Type conversion / Coercion / Automatic type conversion

It is done by compiler automatically: example:
`printf("%f", 20/3.00);`

b) Explicit Type conversion / A cast

By preceding the expression with type in parenthesis It may be checked, unchecked or bit pattern.

Syntax:

```
(type)  
expressio  
n;
```

Example:

```
result=(float) 20/3;
```

If one tries to store a real number in a variable of type integer the part after decimal will be truncated.

8 Drawing a flowchart write a C program to compute simple and compound interest by given principle, rate and time/term. 10

```
#include<stdio.h>  
  
#include<math.h>  
  
int main()  
{  
  
    int p,t;  
  
    float r,si,amount,ci;
```

```

printf("Please enter principal,time and rate of interest");

scanf("%d%d%f",&p,&t,&r);

si=p*t*r/100;

//Simple Interest formula is p*t*r

printf("\nSimple interest = %.3f",si);

//Compound Interest formula is below

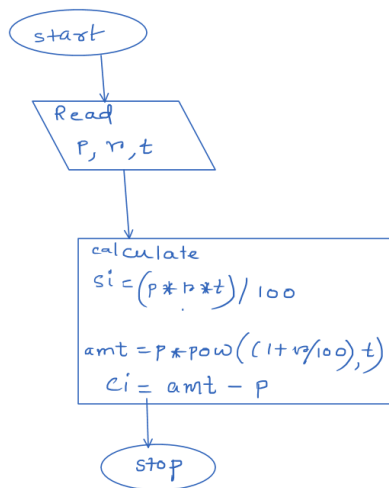
amount=p*pow((1+r/100),t);

ci=amount-p;

printf("\nCompound interest = %.3f",ci);

}

```



9 Write a C Program to create a Multiplication table of given number.

10

```

1  #include<stdio.h>
2  int main(){
3      int num,i;
4      printf("\nEnter the number");
5      scanf("%d",&num);
6
7      for(i=1 ; i<=10 ; i++)
8      {
9          printf("%d x %d = %d\n",num,i,num*i);
10     }
11     return 0;
12 }

```

```

❖ cc MulTable.c
❖ ./a.out

Enter the number7
7 x 1 = 7
7 x 2 = 14
7 x 3 = 21
7 x 4 = 28
7 x 5 = 35
7 x 6 = 42
7 x 7 = 49
7 x 8 = 56
7 x 9 = 63
7 x 10 = 70
❖ █

```