

Number Systems

Date _____

No. _____

Conversion of Decimal to Binary

Convert Decimal to Binary

$$\begin{array}{r}
 2 \mid 13 \\
 2 \mid 6 - 1 \\
 2 \mid 3 - 0 \\
 1 - 1
 \end{array}$$

100001101₂

0 - 8	1100
1 - 4	110
2 - 2	11
3 - 1	1
4 - 0	

Convert Binary to Decimal

$$\begin{array}{ccccccccc}
 2^7 & 2^6 & 2^5 & 2^4 & 2^3 & 2^2 & 2^1 & 2^0 \\
 0 & 1 & 0 & 1 & 0 & 1 & 1 & 0_2 \\
 128 & 64 & 32 & 16 & 8 & 4 & 2 & 1 \\
 64 + 16 + 4 + 2 \\
 86_{10}
 \end{array}$$

$$\begin{array}{lll}
 2^0 = 1 & 2^4 = 16 & 2^8 = 256 \\
 2^1 = 2 & 2^5 = 32 & 2^9 = 512 \\
 2^2 = 4 & 2^6 = 64 & 2^{10} = 1024 \\
 2^3 = 8 & 2^7 = 128
 \end{array}$$

Binary Addition

$$\begin{array}{r}
 \begin{array}{ccccccc}
 & 1 & 1 & 1 & 1 & 1 & 1 \\
 & \downarrow & \downarrow & \downarrow & \downarrow & \downarrow & \downarrow \\
 1 & 0 & 1 & 1 & 0 & 1 & 0_2
 \end{array} \\
 + \begin{array}{r}
 1 & 1 & 1 & 1 & 0 & 1_2
 \end{array} \\
 \hline
 1 & 1 & 0 & 1 & 0 & 1 & 0_2
 \end{array}$$

Conversion of Binary to Decimal

$$1 + 0 \rightarrow 1$$

$$1 + 1 \rightarrow 10$$

$$1 + 1 + 1 \rightarrow 11$$

Binary Subtraction

$$\begin{array}{r}
 \begin{array}{r}
 \begin{array}{r}
 101_2 \\
 \times 10_2 \\
 \hline
 010_2
 \end{array} \\
 - \frac{1_2}{01_2}
 \end{array}
 \end{array}$$

$$\begin{array}{r}
 101_2 \\
 - 10_2 \\
 \hline
 01_2
 \end{array}$$

$$1 - 0 \rightarrow 1$$

$$1 - 1 \rightarrow 0$$

Convert Decimal to Octal8 | 1264₁₀

8 | 158 - 0

8 | 19 - 6

8 | 2 - 3

0 - 2

101102360₈//

2113

1 - 1

0 - 1

1 - 1

Convert Octal to Decimal

$$\begin{array}{r} 1 \ 0 \ 7 \ 1 \\ 8^3 \ 8^2 \ 8^1 \ 8^0 \end{array}$$

$$(1 \times 8^3) + (7 \times 8^1) + (1 \times 8^0)$$

$$512 + 56 + 1 = 569$$

569,₁₀//

$$1 \ 0 \ 1 \ 0 \ 1 \ 0 \ 1 \ 0$$

$$1 + 2 + 4 + 8 + 16 + 4096 = 4123$$

$$4123$$

4123

Convert Octal to Binary

$$\begin{array}{r} 6 \ 0 \ 4 \leftarrow 3_8 \\ 4 \ 2 \ 1 \ 4 \ 2 \ 1 \ 4 \ 2 \ 1 \\ 1 \ 1 \ 0 \ 1 \ 0 \ 0 \ 0 \ 1 \ 1_2 // \end{array}$$

$$\begin{array}{r} 0 \rightarrow 00011011 \\ 1 \rightarrow 00111111 \\ 2 \rightarrow 001001011 \\ 3 \rightarrow 011 \end{array}$$

$$4 \rightarrow 100$$

$$\begin{array}{r} 3 \ 5_8 \\ 4 \ 2 \ 1 \ 4 \ 2 \ 1 \\ 1 \ 1 \ 0 \ 1 \ 0 \ 1_2 \\ 11101_2 // \end{array}$$

$$\begin{array}{r} 5 \rightarrow 101 \\ 6 \rightarrow 0110 \\ 7 \rightarrow 111 \\ 8 \rightarrow 10 \end{array}$$

Convert Binary to Octal

1 1 1 1 1 1 O₂

$$\begin{array}{r} 0 \ 0 \ 1 \\ 4 \ 2 \ 1 \\ \hline 4 \ 2 \ 1 \end{array}$$

$$1 \quad 4+2+1 \quad 4+2$$

$$7 \quad 6 \quad \leftarrow$$

$$1 \quad \leftarrow \quad 7-1$$

176₈

loring@
01

Octal Addition

$$\begin{array}{r} 1 \ 1 \ 1 \\ 5 \ 6 \ 7 \\ + 2 \ 4 \ 3 \\ \hline 1 \ 0 \ 3 \ 2 \end{array}$$

$$7+3 \rightarrow 10 \rightarrow 8 \underline{1} 0 \quad C \rightarrow 1 - 2 \leftarrow S$$

$$6+4+1 \rightarrow 11 \rightarrow 8 \underline{1} 1 \quad 1-3$$

$$5+2+1 \rightarrow 8 \rightarrow 8 \underline{1} 8 \quad 1-0$$

Octal Subtraction

$$\begin{array}{r} 6 \\ \times 3 \\ \hline - 5 \ 6 \ 4 \\ \hline 1 \ 5 \ 7 \end{array}$$

$$\begin{array}{r} 8+3=11 \\ 11-8=3 \\ 3-3=0 \end{array}$$

Hexadecimal Number System

Decimal
10

Hexadecimal

$$\begin{array}{r} 6 \\ + 10 \\ \hline 16 \end{array}$$

0	\longrightarrow	0
1	\longrightarrow	1
2	\longrightarrow	2
3	\longrightarrow	3
4	\longrightarrow	4
5	\longrightarrow	5
6	\longrightarrow	6
7	\longrightarrow	7
8	\longrightarrow	8
9	\longrightarrow	9
10	\longrightarrow	A
11	\longrightarrow	B
12	\longrightarrow	C
13	\longrightarrow	D
14	\longrightarrow	E
15	\longrightarrow	F

Convert Decimal to Hexadecimal

$$\begin{array}{r} 16 \mid 479 \\ 16 \mid 29 - 15 \\ 16 \mid 1 - 13 \\ \hline 0 \quad - 18 \end{array}$$

↓

$$\begin{array}{l} 0 = 0 \\ 1 = 1 \\ 13 = D \\ 15 = F \end{array}$$

0101011101
 $01DF_{16}$

$0010 \leftarrow 2$

$2+8 \quad 2+4+8 \quad 2$

$01 \quad A$

$0101 \quad E = 41$

$1110 \leftarrow 5$

$C = 12 \leftarrow 8$

$1001 \leftarrow 9$

$0101 \leftarrow 5 = 16$

$A = 10$

Convert Hexadecimal to Decimal

$0011 \leftarrow 0$

$101011F \leftarrow 07 \quad 1$

$0111 \quad 16^2 + 16^1 + 16^0$

$1111 \leftarrow 7$

$F = 15$

$D = 13$

$$(15 \times 16^2) + (7 \times 16^1) + (13 \times 16^0)$$

$$(15 \times 256) + 112 + 13$$

3965_{10}

Method of conversion

Convert Hexadecimal to Binary

3 B 7

$B = 11$

$2 \rightarrow 01 \quad 1 \leftarrow 0$

$3 \quad 11 \quad 7$

$8 + 3 @ 0 \quad 8 + 3 @ 0 \quad 8 + 3 @ 0$

$1011 \quad 1011 \quad 0 + 1 + 1$

$8 - 1 \quad 8 - 1 \quad 8 - 1$

$2 \rightarrow 1 \quad 1 \quad 1$

$1 \quad 1 \quad A \downarrow$

$1 \quad 0 \quad 1 +$

$0A \quad 8 \quad 3 \quad 1$

$2 \rightarrow 01$

ProMate

Convert Binary to Hexadecimal

1011101010₂

0 0 1 0 1 1 1 0 1 0 1 0
 ↓ ↓ ② 1 ↓ ④ ② 1 ↓ ⑧ + ② 1

2 8+4+2 8+2

14 10

14 = E 10

0 → 0000

1 → 0001

2 → 0010

3 → 0011

4 → 0100

5 → 0101

6 → 0110

7 → 0111

8 → 1000

9 → 1001

A → 1010

2EA₁₆

Conversion of Binary to Hexadecimal

C → 1100

D → 1101

E → 1110

F → 1111

13 = D

12 = C

Hexadecimal Addition

$$\begin{array}{r}
 5 \ 6 \ 8 \ 9_{16} \\
 + 4 \ 5 \ 7 \ 4_{16} \\
 \hline
 9 \ B \ F \ D_{16} \\
 \hline
 11 \ 15 \ 13
 \end{array}$$

Conversion of Hexadecimal to Binary

$$\begin{array}{r}
 1 \ 1 \ 1 + C \\
 \downarrow A \ D \ D \\
 + D \ A \ D \\
 \hline
 1 \ 8 \ 8 \ A \\
 \hline
 10 \leftarrow S
 \end{array}$$

$$\begin{array}{r}
 11 = B \\
 D + D \rightarrow 13 + 13 \rightarrow 26 \rightarrow 16 \mid 26 \\
 C \rightarrow 1 - 10 \leftarrow S
 \end{array}$$

$$\begin{array}{r}
 11 = F \\
 D + A + 1 \rightarrow 13 + 10 + 1 \rightarrow 24 \rightarrow 16 \mid 24 \\
 1 + 10 + 1 \rightarrow 11 = F
 \end{array}$$

$$\begin{array}{r}
 1101 \ 1101 \\
 A + D + 1 \rightarrow 10 + 13 + 1 \rightarrow 24 \rightarrow 16 \mid 24 \\
 1 - 8 \quad \text{ProMate}
 \end{array}$$

Hexadecimal Subtraction

$$\begin{array}{r}
 22-9 & 16+3=19 \\
 \begin{array}{c} 16 \\ \downarrow \\ 6 \end{array} & \begin{array}{c} 10 \\ \downarrow \\ 3 \end{array} & \begin{array}{c} 16 \\ \downarrow \\ 11 \end{array} \\
 8 & \cancel{7} & \cancel{B} \\
 - & \underline{5 \ 8 \ 7} & C_c=12 \\
 \hline
 3 & E & C & F \\
 \hline
 14 & 12 & 15
 \end{array}$$

SCD (Sign Change Method)

0000	-	0
1000	-	1
0100	-	C
1100	-	E
0010	-	F
1010	-	2
0110	-	3
1110	-	5
0001	-	8
1001	-	B

x7

815
00011110

$$\begin{array}{r}
 00011110 - 8EF_{10} \\
 11000001 - 8D9_{10} \\
 00010000 - 80F2_{10}
 \end{array}$$

Number Representation

Date

No

BCD (Binary Coded Decimal)

0	-	0000
1	-	0001
2	-	0010
3	-	0011
4	-	0100
5	-	0101
6	-	0110
7	-	0111
8	-	1000
9	-	1001

Ex:

$$\begin{array}{r} 7 \mid 8 \\ 0111 \mid 1000 \end{array}$$

01. 738 - 0111 0011 1000₂
02. 903 - 1001 0000 0011₂
03. 5708 - 0101 0111 0000 1000₂

Zone decimal Representation

Z → 1111

0011 ← +

+ → 1100

1011 ← -

- → 1101

7

Ex:

+35

P8E+

1111 0011 1100 0101 0001 1110
 zone 3 sign 5 value (+)

0111-

-54

1011 0000 1000 1001 1000
 1111 0101 1101 0100
 zone 5 sign 4 value (-)

$$\begin{array}{r} 0011 1100 0100 1110 0001 = 858 \\ + \quad 1 \quad 2 \quad 5 \quad 8 \\ \hline \end{array} = 858 + 10$$

Q1. +3345 = 1111 0011 1111 0011 1111 0100 1100 0101
 zone 3 zone 3 zone 3 sign PPP 5 so
 value - 0 0 0 P P P value (+)

Q2. -6822 = 1111 0110 1111 1000 1111 0010 1101 0010
 zone 6 zone 8 zone 1002 sign PPP 2 so
 value 1 0 0 P P P P value (-)

Q3. 920 = 1111 1001 1111 0010 1111 0000
 zone 9 zone 2 zone 0 value

Packed Decimal Representations.

+ → 1100

- → 1101

1111 ← 5

0011 ← +

1011 ← -

Ex:

+789

28 +

$$\begin{array}{ccccccc}
 & \overbrace{0111} & \overbrace{1000} & \overbrace{1001} & \overbrace{\textcolor{red}{1100}} & \overbrace{1100} & \overbrace{1111} \\
 & 7 & 8 & 9 & + & 8 & 9 \\
 & \text{value} & \text{value} & \text{value} & \text{sum} & \text{sum} & \text{sum}
 \end{array}$$

-1910

42 -

$$\begin{array}{ccccccc}
 & \overbrace{0001} & \overbrace{1001} & \overbrace{0001} & \overbrace{0000} & \overbrace{\textcolor{red}{1101}} & \\
 & 1 & 9 & 0 & 0 & 1111 & \\
 & \text{value} & \text{value} & \text{value} & \text{sum} & \text{sum} & \text{sum}
 \end{array}$$

01. +8723 = $\begin{array}{ccccc} \overbrace{1000} & \overbrace{0111} & \overbrace{0010} & \overbrace{0011} & \overbrace{1100} \\ 8 & 7 & 2 & 3 & + \end{array}$

02. -9902 = $\begin{array}{ccccc} \overbrace{1001} & \overbrace{1001} & \overbrace{0000} & \overbrace{0010} & \overbrace{1101} \\ 9 & 9 & 0 & 2 & - \end{array}$

03. -9991 = $\begin{array}{ccccc} \overbrace{1001} & \overbrace{1001} & \overbrace{1001} & \overbrace{0001} & \overbrace{1111} \\ 9 & 9 & 9 & 1 & - \end{array}$

0000 1111 0100 1111 1001 1111 = 088 - 0

0 5005 S 5005 P 5005

Ones Complement Representation.

$$\begin{array}{r}
 7 \\
 +7 \\
 \hline
 (-7) \text{ 1's}
 \end{array}
 \quad - \quad
 \begin{array}{r}
 0000\ 0111 \\
 0000\ 0111 \\
 \hline
 1111\ 1000
 \end{array}$$

21. 10. 0

01. -27 20 NOV 31

卷之三

~~128 64 32 16 8 4 2~~

~~27 - 0 0 0 1 1 0 1 1~~

(-27) 1's → 1 1 1 0 0 1 0 0

$$+8 \rightarrow 0000\ 1000$$

$$\left. \begin{array}{r} * -6 \\ + 6 \end{array} \right\} \rightarrow 0000 \ 0110$$

~~#1111 0011 → 1's
0000 1100 → 2's~~

22 42

128 64 32 16 8 4 2 1
42 → 0 0 1 0 1 0 1 0

03.11111001

* You write ones
complements only
for (-) numbers.

$$\begin{array}{l} 1's \rightarrow 1\ 1\ 1\ 1\ 0\ 0\ 1 \\ Bin \rightarrow 0\ 0\ 0\ 0\ 0\ 1\ 1\ 0 \\ \quad \quad \quad \downarrow \quad \quad \quad \downarrow \quad \quad \quad \downarrow \\ \quad \quad \quad 128\ 64\ 32\ 16\ 8\ \textcircled{4}\ \textcircled{3}, \end{array}$$

$$2+4=6 \rightarrow -6$$

$$\begin{array}{r} \cancel{01011111} \leftarrow (+) \\ - 10100000 \leftarrow (-) \\ \hline 01010001 \end{array}$$

Ones Complement Addition

01. $5 - 3$

$$(+5) + (-3)$$

128 64 32 16 8 4 2 1

$$+5 \rightarrow 0000\ 0101 \quad \textcircled{1}$$

$$+3 \rightarrow 0000\ 0011$$

$$1's \rightarrow (-3) \rightarrow 1111\ 1100 \quad \textcircled{2}$$

$$\begin{array}{r} \textcircled{1} + \textcircled{2}, \\ 0000\ 0001 \\ \hline 0000\ 0010 \end{array} \rightarrow +2$$

*if you get a
9th bit take
it to LSB
and add.

02. $7 - 12$

$$(+7) + (-12)$$

addition (-)

128 64 32 16 8 4 2 1

$$+7 \rightarrow 0000\ 0111 \quad \textcircled{1}$$

$$+12 \rightarrow 0000\ 1100$$

$$1's \rightarrow (-12) \rightarrow 1111\ 0011 \quad \textcircled{2}$$

 $\textcircled{1} + \textcircled{2},$

$$(+7) \rightarrow \underline{\underline{1111\ 1010}}$$

$$(-12) \rightarrow \underline{\underline{0000\ 0101}} \rightarrow -5$$

03. -10 -5

~~Two's Complement from binary~~

$$(-10) + (-5)$$

~~Two's Complement from binary~~

$$\begin{array}{r}
 \text{128} \ 64 \ 32 \ 16 \ 8 \ 4 \ 2 \ 1 \\
 +10 \rightarrow 0000 \ 1010 \\
 1's = -10 \rightarrow 1111000101 \xrightarrow{\textcircled{1}} 21 \leftarrow (\text{F}-) \\
 +5 \rightarrow 0000 \ 0101 \\
 1's = -5 \rightarrow \underline{111101010} \xrightarrow{\textcircled{2}} 21
 \end{array}$$

(1 + 2),

$$\begin{array}{r}
 1110 \ 111 \\
 \hline
 \rightarrow 1 +
 \end{array}$$

(+) → 1111 0000

(-) → 0000 1110 → -15

exponent (-2) $\times 2^2$

SS - 88

$$\begin{array}{r}
 0110 \ 0000 \leftarrow \text{SS} \\
 1001 \ 0110 \xrightarrow{\text{+1}} 21 \\
 +1 \\
 \hline
 0101 \ 0110 \leftarrow \text{SS}
 \end{array}$$

Two's Complement Representation

2-01-80

Diagram illustrating the conversion of decimal numbers to 4-bit binary representations:

- +7** → 0000 0111
- 7** → 1111 1000

The conversion for **-7** is shown with a two-step process:

- 1's:** The number 1111 1000 is shown with a circled 1 at the leftmost position.
- 2's:** The number 1111 1000 is shown again, with a circled 1 at the leftmost position and a circled 1 at the least significant bit (LSB).

A red box highlights the circled 1 at the LSB with the note: ***To make 2's add 1 to LSB**.

01. 18 + 1 ←
128 64 32 16 8 4 2 1 1 1 1
18 → 0001 0010 10000

You write two
complement only
for (-) numbers.

$$\begin{array}{r}
 02. -22 \\
 \\
 \begin{array}{ccccccccc}
 1 & 2 & 5 & 6 & 4 & 3 & 2 & 1 & 0 \\
 22 & \rightarrow & 0 & 0 & 0 & 1 & 0 & 1 & 1 0 \\
 1'8 & \rightarrow & 1 & 1 & 1 & 0 & 1 & 0 & 0 1 \\
 2'8 & \rightarrow & \underline{\underline{1}} & \underline{\underline{1}} & \underline{\underline{1}} & \underline{\underline{0}} & \underline{\underline{1}} & \underline{\underline{0}} & \underline{\underline{1}} 0
 \end{array}
 \end{array}$$

Twos Complement Addition.

Q1. 5 - 3

$$5 + (-3)$$

$$5 \Rightarrow 0000\ 0101 \quad \text{---} \textcircled{1}$$

$$3 \Rightarrow 0000\ 0011$$

$$(-3) 1's \Rightarrow 1111\ 1100$$

$$(-3) 2's \Rightarrow \underline{\underline{1111\ 1101}} \quad \text{---} \textcircled{2}$$

(1) + (2),

~~$$\underline{\underline{0000\ 0010}}$$~~

* In two's complement
if you get a 9th bit you can remove it.

$$\underline{\underline{0000\ 0010}}$$

M&R

Careful

Computer Storage Structure.

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- * Computer storage devices can be divided into 2 categories.

01. Primary Storages.

- Storages which has direct contact with CPU.

02. Secondary Storages.

- Storages which doesn't have direct contact with CPU.

01) Primary Storages.

ROM

* Read-only memory is an unchangeable memory which contain inside computer.

* Since ROM data are not frequently changed programs like system bootup will store inside it.

RAM

* Random Access Memory is a volatile memory which has direct contact with processor.

* Inside RAM data will get stored temporary.

Cache Memory

* Cache is a small memory which resides in between CPU and RAM.

* Cache memory contains, frequently requested data from computer.

02) Secondary Storages

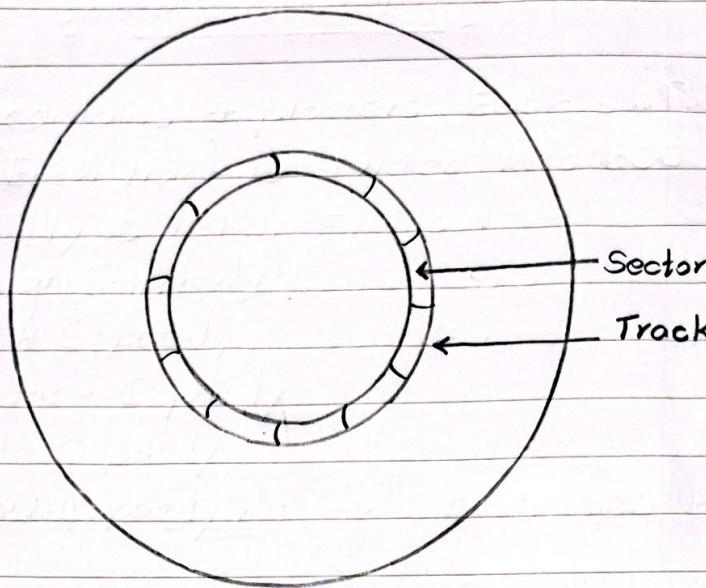
- * Secondary storages can also categorised as internal and external devices.
- * All of these devices doesn't have access to the CPU directly and it will access CPU via primary storages.

Hard Disk Drive (HDD)

- * HDD created by using flat pieces which known as platters.
- * HDD consist with number of platters which stack on top of each other.
- * Each platter has a dedicated R/W Head (read-write head) which used to store and read data.
- * Platters are rotating in certain RPM level (rounds per minute) and R/W Head will move and store data all over the platter.

Data Storing inside HDD

- * Data will store inside data storing surfaces.
- * When considering a platter it has 2 data storing surfaces.
- * Each surface will divided into equal number of tracks.
- * Each track is divided into equal number of sectors.
- * Each platter have 2 R/W Heads for both surfaces.



HDD Calculations.

(01) Capacity of a Track.

* Capacity of a track = No. of sectors \times size of the sector

(02) Capacity of the Surface.

* Capacity of a surface = Capacity of a track \times No. of tracks in the surface.

(03) Capacity of total HDD.

* Capacity of total HDD = Capacity of a surface \times No. of surfaces

(Q4) Capacity of a Cylinder

* Capacity of a cylinder = Capacity of a track \times No. of tracks \times Number of surfaces

(Q1) HDD has 3 platters. Each surface has 300 tracks. Track is divided into 100 sectors. 1 sector size is 4kb. Find out,

- i. Track capacity
- ii. Surface capacity
- iii. Platter capacity
- iv. Cylinder capacity
- v. HDD capacity

$$\text{i. } T = 100 \times 4 \text{ Kb}$$

$$\text{ii. } S = 100 \times 4 \times 300 \text{ Kb}$$

$$\text{iii. } P = 100 \times 4 \times 300 \times 2 \text{ Kb}$$

$$\text{iv. } C = 400 \times 6 \text{ Kb}$$

$$\text{v. } H = 100 \times 4 \times 300 \times 2 \times 3 \text{ Kb}$$

* Tracks = Cylinders.

* 1 Plate = 2 Surfaces

(Q2) A hard disk contains 4 platters. Each surface has 400 tracks. Each track is divided into 800 sectors. Cylinder capacity is 16Mb. Find out,

- i. Sector Capacity
- ii. Track Capacity
- iii. Surface Capacity
- iv. Plate Capacity
- v. HDD Capacity

$$\text{I. } 8 \text{ Tracks} \rightarrow 16 \text{ Mb}$$

$$1 \text{ Track} \rightarrow 2 \text{ Mb}$$

$$S = \frac{2048}{800} \text{ Kb}$$

$$\text{II. } T = 2 \text{ Mb}$$

$$\text{III. } S = \frac{2048 \times 400}{800} \text{ Kb}$$

$$\text{IV. } P = 800 \times 2 \text{ Mb}$$

$$\text{V. } H = 800 \times 2 \times 4 \text{ Mb}$$

(Q3) The HDD size is 80GB. And this HDD contains 4 platters. Each surface has 500 tracks. A track is divided into 50 sectors.

i. Sector size.

ii. Track size.

iii. Cylinder size.

iv. To store 1.2Mb song, how many sectors are needed.

$$\text{HDD} \rightarrow 80\text{GB}$$

$$1 \text{ Plate} \rightarrow \frac{80}{4} = 20\text{GB}$$

$$1 \text{ Surface} \rightarrow \frac{20}{2} = 10\text{GB}$$

$$1 \text{ Track} \rightarrow \frac{\pi \times 10^2}{500} \times 1000 \text{ Mb} = 20\text{Mb}$$

$$1 \text{ Sector} \rightarrow \frac{20}{50} \text{ Mb} = 0.4\text{ Mb}$$

$$1 \text{ Cylinder} \rightarrow 20 \times 8 \text{ Mb} = 160\text{Mb}$$

To store a 1.2Mb Song 3 sectors are needed. (1.2/0.4)

* Use 1000 instead of 1024.

Image Representation.

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Ex:

1000 × 1000 pixel image with 8 bits per pixel

$$\begin{aligned}\text{Total No. of pixels} &= 1000 \times 1000 \\ &= 1,000,000\end{aligned}$$

* Binary = 1 Pixel = 0 or 1 → 1,000,000 bits

$$= \frac{1,000,000}{8} \text{ bytes}$$

$$= 125,000 \text{ bytes.} //$$

* Grayscale = (0-255) = (8 bit) = (1 byte) → 1,000,000 bytes //

* Colour

R G B

↓ ↓ ↓

0-255 0-255 0-255

↓ ↓ ↓

$$8 \text{ bit } 8 \text{ bit } 8 \text{ bit } \rightarrow 24 \text{ bit } = \frac{24}{8} \text{ byte } = 3 \text{ byte}$$

$$\begin{aligned}&= 1,000,000 \times 3 \text{ byte} \\ &= 3,000,000 \text{ byte.} //\end{aligned}$$

* 8 bit = 1 byte

Q1) Differentiate the images available (GIF, JPEG, PNG, BMP) and explain its usage.

- * **JPEG** ^{best} in terms of file size and in consideration of high resolution images. It's ideal for both web & print.
- * **PNG** has an advantage with regard to versatility. It's a lossless compression and ideal for images with text or sharp lines and edges between colors.
- * **BMP** doesn't have real advantages over JPEG and PNG because it is an uncompressed format that generates a larger file size.
- * **GIF** has made a comeback, especially in social networking sites in which animated GIFs provide an entertainment value.
- * One of the notable advantages of JPEG over the PNG is that it can achieve a smaller file size for a relatively similar image quality and resolution. This is ideal for storage and online content consumption.
- * PNG is not good for large or high-resolution images because it generates a large file size.
- * JPEG generally generates a smaller file size than PNG for a similar image with the same resolution.
- * The main advantage of GIF over JPEG and PNG is that it compresses digital images to a smaller file size by reducing the number of colors and replacing multiple occurring patterns into one.
- * BMP format is not a compression standard. Images encoded as a bitmap are very large in terms of file size. Hence, the notable disadvantage of BMP over JPEG and PNG include poor scalability.

Introduction to Networks.

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(Q1) What is networking and internetworking?

Networking: Interconnection of computers / devices.

Internetworking: Interconnection of networks.

(Q2) What is LAN, MAN & WAN?

* LAN is a group of network devices that allow communication between various connected devices. It covers small areas.

* MAN connects two or more computers that reside within the same or completely different cities. It covers a larger area than LAN.

* WAN covers a large area than LAN and MAN, such as country / continent etc.

(Q3) What is file server, print server, application server, message server & database server?

* File server hosts all kinds of files usually through a different protocol with web servers such as FTP.

* Print server is just a device used to allow multiple users to queue their print jobs to the printer.

* Application server runs the programs and processes the data.

* Message server sends, receives and relays messages.

* Database server hosts databases. Websites use databases to store different kinds of information such as login names and passwords.

(Q4) What is computer network and what are the different types of networks available?

A network refers to 2 or more connected computers that can share resources such as data, a printer, an internet connection, applications or a combination of these resources.

LAN

broadband

MAN

metropolitan

WAN

world wide

Introduction to Internet.

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(Q1) Write examples for standalone applications (desktop applications) and web based applications.

- **Standalone applications. (Desktop Applications)**

Notepad.

Calculator.

MS Word

PS

Google charm

- **Web-based applications.**

Google docs.

Gmail.

Facebook.

Canva.