=> Explain the following models with example:

(a) Physical Model:

In Data Compression, Physical model is used to represent data compression using the physical characteristics.

In this model, Data's physical characteristics used for the compression.

Physical Model used structure or patterns for compression of data.

Ex. Image Compression, Audio Compression, Video and Text Compression etc.

(b) Probability Model:

In Probability Model, We have to used Probability of every data For perform the compression.

Probability Model are used to assign shorter codes to more probable symbols to achieve better compression ratios.

There are two type of Probability Model : Static and Adaptive Probability Model.

Ex. Huffman Coding and Arithmetic coding.

(c) Markov Model :

Markov Model is one type of the Probability Model which is used when probability of event depends on the recent history of events.

First-Order Markov Model is used for data compression.

The First-Order Markov Model is used to estimate the conditional probabilities.

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(d) Composite Source Model:

Composite Source Model is used when the source of data can be modeled as a combination of multiple sub-sources.

Composite Source Model is often used to capture the diversity or complex of data.

4 What is Uniquely Decodable Code? Write Down the steps to Check code is UDC or not.

=> A sequence of code that is decodable in only one way then it is called Uniquely Decodable Code.

Uniquely Decodable Code is always decode in only one way.

IF any code have its prefix so, this code is not be Uniquely Decodable Code.

There is only one way to decode the code if it is a Uniquely Decodable Code.

=> Steps:

1 First Group all the code word.

2 IF No Prefix code found for any code word, then it is called UDC.

3 else, Prefix code found then add the Dangling Sufix to the code word.

4 IF, After the adding the Dangling Sufix if New code word = Some code word exits.
then, it is not UDC.

5 else, it is UDC.

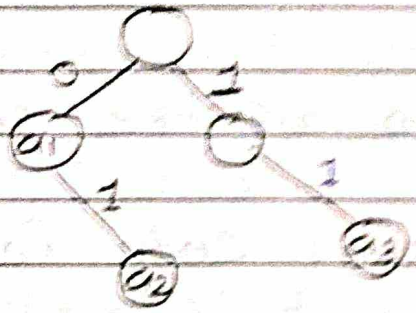
=> Check whether following code are UDC or not ?

(a) {0, 10, 110, 111}

(a) {0, 01, 11}

Here, There is no Prefix code.
So, we have to create binary

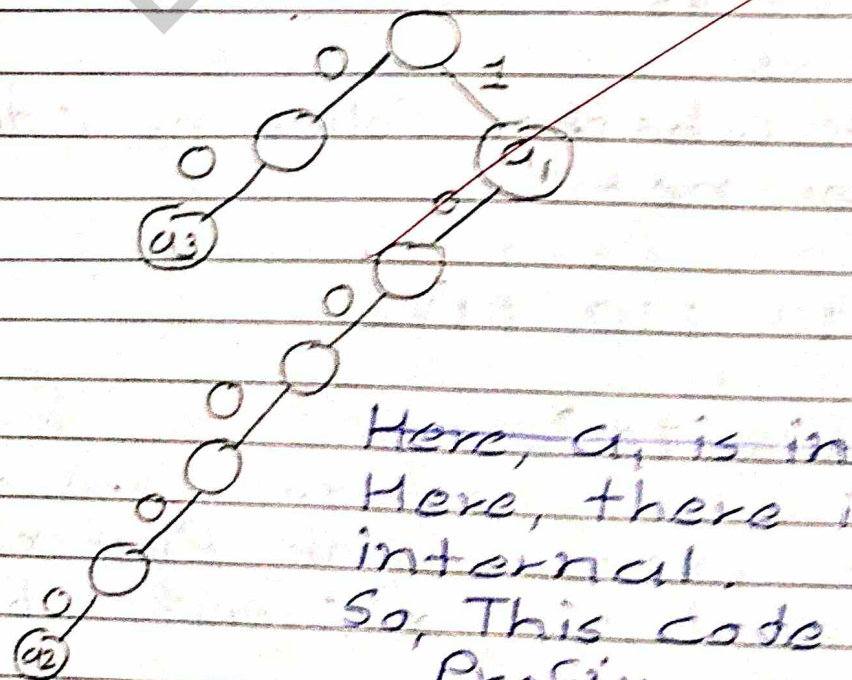
tree for the Prove,



Here, There is No Internal Node
So, It is Prefix code and
UDC code.

(b) {1, 100000, 00}

First, We have to create the Binary Tree, for the check it is Prefix or not,



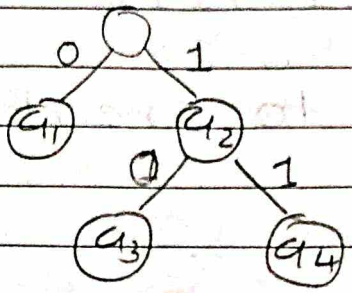
Here, a_1 is internal
Here, there is no internal.
So, This code is Prefix.

5 Explain Prefix code with example

=> If any code is not Prefix of any other code word then the code is called Prefix code.

Ex. {0, 1, 10, 11}

For check the code is Prefix or not we have to create a Binary tree.

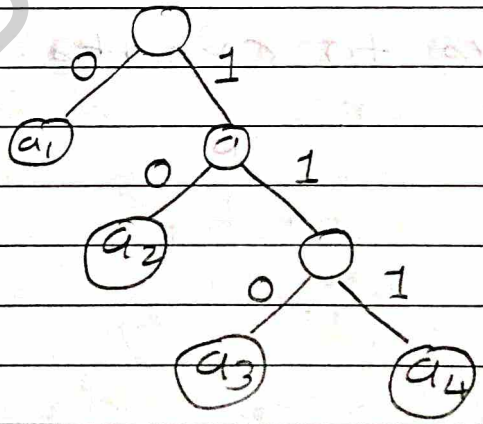


Here, a_2 is internal node.
So, This code is not Prefix code.

=) Check Whether following code is prefix code?

(a) {0, 10, 110, 111}

First, We have to create the Binary Tree.



Here, There is no Internal Node.
So, This code is Prefix.

6 Calculate the First-Order Entropy.

(a) P(a1) = 1/2 P(a3) = 1/8
P(a2) = 1/4 P(a4) = 1/8

	Probability	H	Code	Length
a1	0.5	-0.5	00	2
a2	0.25	-0.5	01	2
a3	0.125	-0.375	10	2
a4	0.125	-0.375	11	2

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Entropy $H(X) = -\sum_{i=0} P(x_i) \cdot \log_2 P(x_i)$

$H(X) = [-0.5 \log_2 0.5 + 0.25 \log_2 0.5 + 0.125 \log_2 0.125 + 0.125 \log_2 0.125]$

$H(X) = 1.75$