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ITC Tutorial-3

(Q.1) Encode the message "PROOF" using arithematic coding.

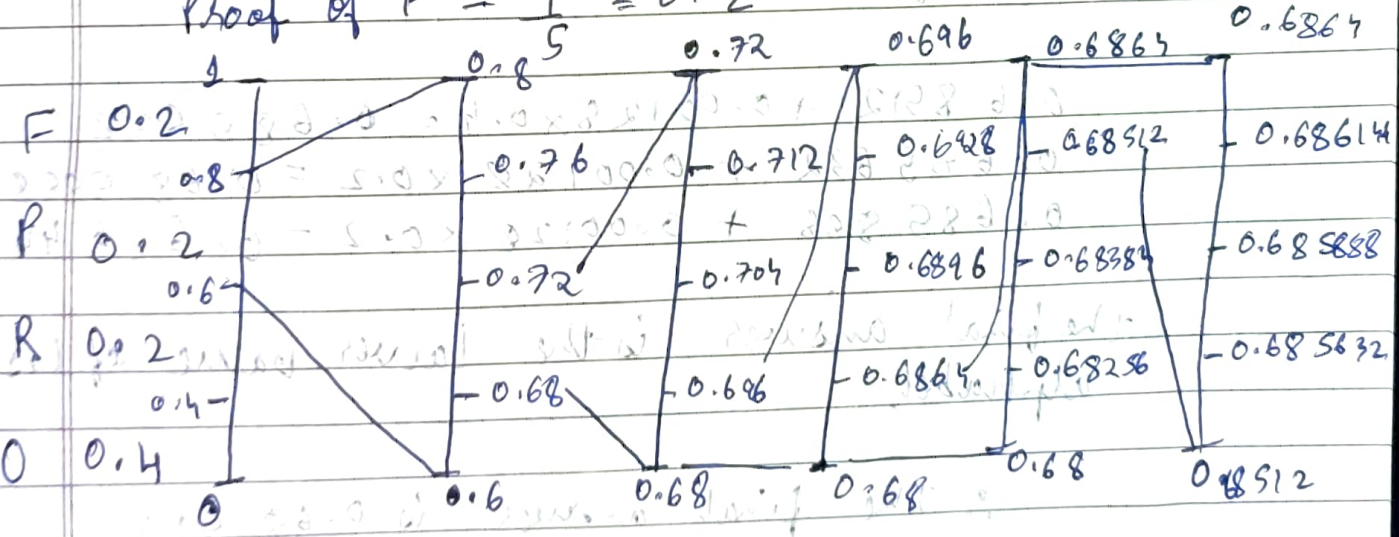
(Q.2) Encode message - "banana - ba dadaa" using LZW coding.

(Q.3) Encode the following using run length coding.
S = 1111111111111111000000000000000011111

(Ans 1) Proof of 'P' $= \frac{1}{5} = 0.2$ Proof of 'O' $= \frac{2}{5} = 0.4$

Proof of 'R' $= \frac{1}{5} = 0.2$

Proof of 'F' $= \frac{1}{5} = 0.2$



(For P) $\Rightarrow 0.6 + 0.2 \times 0.4$

$= 0.68$

$0.68 + 0.2 \times 0.2$

$= 0.68 + 0.04$

$= 0.72$

$= 0.72 + 0.2 \times 0.2$

$= 0.76$

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For 'R' ⇒

$0.68 + 0.04 \times 0.4 = 0.696$

$0.696 + 0.04 \times 0.2 = 0.704$

$0.704 + 0.04 \times 0.2 = 0.712$

For 'O'

$0.68 + 0.04 \times 0.016 = 0.6864$

$0.6864 + 0.2 \times 0.016 = 0.6896$

$0.6896 + 0.2 \times 0.016 = 0.6928$

For 'O'

$0.68 + 0.0064 \times 0.4 = 0.68256$

$0.68256 + 0.0064 \times 0.2 = 0.68384$

$0.68384 + 0.0064 \times 0.2 = 0.68512$

For 'f'

$0.68512 + 0.00128 \times 0.4 = 0.685632$

$0.685632 + 0.00128 \times 0.2 = 0.685888$

$0.685888 + 0.00128 \times 0.2 = 0.686144$

The final answer is the lower value of last alphabet.

∴ The final answer is 0.68512.

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(Ans 2) Original dictionary

Symbol	Code
B	0
A	1
N	2
-	3
D	4

Input	Current string	Seen Before	Encoded O/P	New dictionary item
P b	b	Yes	–	–
b/a	ba	No	0	ba/5
ba/n	an	No	0, 1	an/6
ban/a	na	No	0, 1, 2	na/7
bana/n	an	Yes	0, 1, 2, 6	–
banan/a	na	Yes	0, 1, 2, 6, 7	–
banana/a-	a-	No	0, 1, 2, 6, 7, 1	a-/8
banana-/s6	-b	No	0, 1, 2, 6, 7, 1, 3	-b/9
banana-b/a	ba	Yes	0, 1, 2, 6, 7, 1, 3, 5	–
banana-ba/d	ad	No	0, 1, 2, 6, 7, 1, 3, 5, 2	ad/10
banana-bad/a	da	No	0, 1, 2, 6, 7, 1, 3, 5, 1, 4	da/11
banana-bada/d	ad	Yes	0, 1, 2, 6, 7, 1, 3, 5, 1, 4, 10	–
banana-badad/a	da	Yes	0, 1, 2, 6, 7, 1, 3, 5, 1, 4, 10, 11	–
banana-badada/a	aa	No	0, 1, 2, 6, 7, 1, 3, 5, 1, 4, 10, 11	aa/12
aa	aa	Yes	0, 1, 2, 6, 7, 1, 3, 5, 1, 4, 10, 11, 1, 12	

∴ Final code is = 0, 1, 2, 6, 7, 1, 3, 5, 1, 4, 10, 11, 1, 12

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(Ans 3) S = 1111 1111 1111 1111 1111 0000 0000 0000 0000 0000 0000 1111

We will make groups here

∴ 15 (1's), 19 (0's), 4 (1's)

Now we will represent natural no into binary form

∴ (1111, 1), (10011, 0), (100, 1)

Total no of original bits - 38

Total no of grouped bits - 15

Compression = $\frac{\text{grouped bits}}{\text{original bits}}$

Compression ratio = $\frac{15}{38}$

= 0.394

∴ Compression ratio is 0.394