

# Assignment - 5

g1]	INDIA	5 chars $\Rightarrow 5 \text{ bytes} \times 8 \Rightarrow 40 \text{ bits}$
	Symbol	Probability
	I	0.9
	N	0.2
	D	0.2
	A	0.2

- ① For first character I  
lower range = 0, upper range = 1  
No. of sub-intervals = 5  
 $\text{Step value} = \frac{1-0}{5} = 0.2$

I ranges from 0 to 0.4

- ② To find 2nd character N

$$\text{lower range} = 0$$

$$\text{upper range} = 0.4$$

$$\text{Step value} = \frac{0.4}{5} = 0.08$$

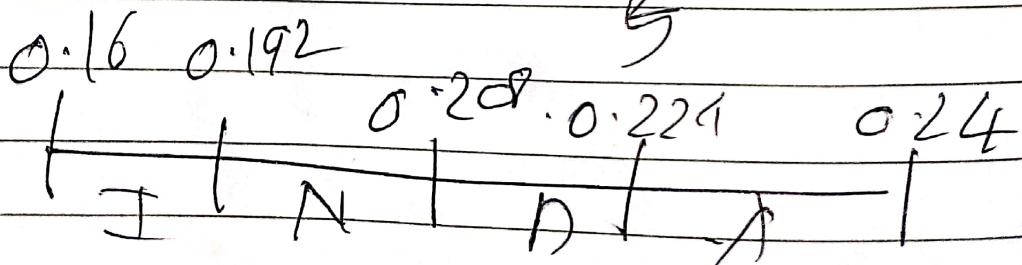
$\therefore N$  ranges from 0.16 to 0.24

- ③ To find 3rd character D

$$\text{lower range} = 0.16$$

$$\text{upper range} = 0.24$$

$$\text{Step value} = \frac{0.24 - 0.16}{5} = 0.016$$



$\therefore D$  ranges from 0.208 to 0.224  
For 4th character  $\Delta$

lower value = 0.208

upper " = 0.228

Step  $\Delta$  0.2181 0.2183 0.2186 0.2208 0.224

D ranges from 0.208 - 0.2144

For 5th character  $\Delta$

Step value = 0.00125  
 $0.208 \quad 0.21056 \quad 0.21184 \quad 0.21312 \quad 0.2148$

$\therefore$  Arithmetic code word  $\Rightarrow 0.21313$

Q3

$$\text{Prob of } 1 = 7/28 = 0.25$$

$$\text{Prob of } 2 = 6/28 = 0.21$$

$$\text{Prob of } 3 = 5/28 = 0.17$$

$$\text{Prob of } 4 = 4/28 = 0.14$$

$$\text{Prob of } 5 = 3/28 = 0.11$$

$$\dots \dots 6 = 0.07$$

$$\dots \dots 7 = 0.035$$

symbol	1	2	3	4	5	6	7
Prob	0.25	0.21	0.17	0.14	0.11	0.07	0.035

symbol	code
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1	01
---	----

2	11
---	----

3	000
---	-----

4	001
---	-----

5	100
---	-----

6	1010
---	------

7	1011
---	------

E

10	10	40	40
20	20	20	20
30	30	40	40
50	50	60	80

 $f(x,y)$  $f(x,y)$  $c(x,y)$ 

10

0

16

10

10

0

40

10

30

40

40

0

20

40

-20

20

20

0

20

20

0

30

30

0

30

30

0

40

30

10

40

40

0

50

40

10

50

50

0

50

50

0

60

50

10

60

60

20

80

60

0

E

10	0	30	0
-20	6	0	0
10	0	10	6
10	0	10	20

Q7

E	[	13	54	12
		13	11	57
	]	11	10	12

Pixel	Bin	sum	IGS code
13	001101	001101	001
54	110110	111011	111
12	001100	001111	001
13	001101	010100	
11	001011	010010	010
57	111001	111011	111
11	001011	001101	001
10	001010	001101	001
12	001100		
$BPP = 27/9 = 3$			

compression Ratio =  $\left( \frac{54-27}{54} \right) \times 100$   
 $= 50\%$

b) encoded image = [	001	111	001
	001	010	111
	010	001	001

IGS Decode O/P

001	001000	8	D = [	8	56	8
111	111000	56		8	16	56
001	001000	8		56	8	8
001	001000	8				
010	010000	16				
111	111000	56				
010	111000	6				
001	001000	8				



$$\begin{aligned}
 \text{MSE} &= \frac{1}{M \times N} \sum_{m=0}^{M-1} \sum_{n=0}^{N-1} [f(x, y) - f(x, y)]^2 \\
 &= \frac{1}{9} * \{25+4+16+25+25+1+25 \\
 &= \frac{1}{9} * \{147\} \\
 &= 15.67
 \end{aligned}$$

$$\text{PSNR} = (57)^2 = 207.339$$