SECTION-7. Answer ⇒ 3

* Golomb Code ⇒

↳ The Golomb-Rice codes belong to a family of code designed to encode integers with the assumption that the larger an integer, the lower its proportional probability of occurrence.

↳ The simplest code for this situation is the unary code.

↳ The unary code for a positive integer n is simply n 1's followed by a 0.

↳ Thus the code for 4 is 11110 and the code for 7 is 11111110.

↳ The unary code is the same as the Huffman code for the semi-infinite alphabet {1, 2, 3, ...} with probability model, or:

$$P[k] = \frac{1}{2^k}$$

↳ Because the Huffman code is optimal, the unary code is also optimal for this

↳ The Golomb code is actually a family of codes parameterized by an integer $m > 0$.

↳ In the Golomb code with parameter m, we represent an integer $n > 0$ using two numbers q and r, where

$$q = \left\lfloor \frac{n}{m} \right\rfloor$$

and

$$\boxed{r = n - qm}$$

↳ $\lfloor x \rfloor$ is the integer part of x.

↳ The quotient q can take on value $0, 1, 2, \ldots$ and is representation by the unary code of q.

↳ The reminder r can take on the values $0, 1, 2, \ldots, m-1$.

↳ If m is a power of two, can could still use $\lceil \log_2 m \rceil$ bits, where $\lceil x \rceil$ is the smallest integer greater than or equal to x.

(b)* Non-binary Huffman code ⇒

↳ The binary-Huffman coding procedure can be easily extended to the non-binary case where the code elements come from an m-ary alphabet. m is not equal to two.

↳ We obtained the Huffman algorithm based on the observations that in an optimum binary prefix code and the requirement that the two symbols with the lowest probability differ only in the last position.

↳ The two symbols that occur least frequently will have the same length.

↳ We can obtain a non-binary Huffman code in almost exactly the same way.

↳ It has the Huffman code to be the easily extented.