

OLYMPIAD · MENTAL ABILITY · OLYMPIAD PREPARATION · SHORT NOTES

Chapter 3: Coding and Decoding

Topic-wise short notes with solved examples

How words and numbers are changed by a fixed rule, how to find the rule, and how to decode a message.

1 Letter coding by a fixed step

- In **coding**, a word is changed into a secret word by a rule. In **decoding** you reverse the rule to read the message.
- The most common rule moves every letter **forward** or **backward** by the same number of places.
- Write the positions: A = 1, B = 2, ..., Z = 26. Compare one letter of the word with the matching letter of the code to find the step.
- If the step is forward ($+k$), decode by going backward ($-k$).

Example 1.1 In a code, MATH is written as NBUI. How is DOG written?

SOLUTION

M to N, A to B, T to U, H to I: every letter moves forward by 1.

D to E, O to P, G to H.

EPH

Example 1.2 In a code, every letter moves forward by 3 places. Decode KHOOR.

SOLUTION

Move every letter back by 3: K to H, H to E, O to L, O to L, R to O.

HELLO

2 Reverse alphabet and position coding

- **Reverse alphabet:** A becomes Z, B becomes Y, C becomes X, and so on. A letter at position n becomes the letter at position $27 - n$.
- **Position coding:** each letter is replaced by its position number. A word can be written as a string of digits or as the **sum** of the positions.

Example 2.1 Write DOG in the reverse alphabet.

SOLUTION

D (4) becomes the letter at position $27 - 4 = 23$, which is W.

O (15) becomes position 12, which is L. G (7) becomes position 20, which is T.

WLT

Example 2.2 If a word is coded as the sum of the positions of its letters, find the code for ACE.

SOLUTION

A = 1, C = 3, E = 5.

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3 Word codes (substitution)

- Here whole words are replaced by code words. A word that appears in **two** sentences must have the code word that appears in both.
- Compare the sentences in pairs. Find the common word and the common code word, then the rest follows.

Example 3.1 In a code, "sky is blue" is "ta ro ki", "blue sea" is "ki pa" and "sea is deep" is "pa ro na". Find the code for "deep".

SOLUTION

"blue" is in the first two sentences, and "ki" is in the first two codes, so blue = ki.

"is" is in the first and third sentences, and "ro" is in both those codes, so is = ro.

"sea" is in the second and third sentences, and "pa" is in both those codes, so sea = pa.

In the third sentence "sea is deep" = "pa ro na", so deep = na.

na

REMEMBER

Always test your rule on the second and third letters of the word, not only the first. Some codes move different letters by different steps.