**Structor**

1. **Game principle**

A player is asked to pick from a set of square tiles with various black-and-white patterns printed on them 25 pieces and arrange them in a five-by-five grid. The player must place all tiles with their patterned side up; placing the bottom-up is not allowed. There exist ten types of distinct tile patterns.

When the player finishes, a picture of his/her pattern will be taken and translated into a digital fingerprint which is understood to represent this person in this particular moment. A player may create a Structor pattern only once in a lifetime.

The following picture is an example of a resulting pattern in the five-by-five grid.

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*Figure 1. Example of a Structor result pattern.*

1. **Analysis of result uniqueness**

There exist two versions of Structor. In the first version, all available tiles were single-sided, and a total amount of 50 tiles existed. The player could pick from this set 25 pieces of his/her liking and arrange them in a five-by-five grid, while having the freedom to rotate each tile as desired. For each tile type, there existed five pieces of the same type. The following table clarifies this.

|  |  |  |  |
| --- | --- | --- | --- |
| Tile ID | Single-sided tile | Number of possible rotations | Number of tiles available |
| 0 |  | 1 | 5 |
| 1 |  | 4 | 5 |
| 2 |  | 4 | 5 |
| 3 |  | 2 | 5 |
| 4 |  | 4 | 5 |
| 5 |  | 4 | 5 |
| 6 |  | 2 | 5 |
| 7 |  | 4 | 5 |
| 8 |  | 4 | 5 |
| 9 |  | 1 | 5 |
|  |  | Total: | 50 |

*Table 1. Tiles available in Structor version 1.*

In the second version of Structor, some tiles are double-sided and hold different patterns on each side. The total number of available tiles is 45. The rest of the games’ rules remain unchanged. Due to the reduced number of tiles available, the number of possible configurations in the five-by-five grid is also smaller than in the first version of Structor. The following table shows the tile configuration for Structor 2.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Tile ID(s) | Tile side 1 | Tile side 2 | Number of possible rotations | Number of tiles available |
| 0, 9 |  |  | 1, 1 | 5 |
| 1 |  |  | 4 | 5 |
| 2 |  |  | 4 | 5 |
| 3 |  |  | 2 | 5 |
| 4 |  |  | 4 | 5 |
| 5 |  |  | 4 | 5 |
| 6 |  |  | 2 | 5 |
| 7 |  |  | 4 | 5 |
| 8 |  |  | 4 | 5 |
|  |  |  | Total: | 45 |

*Table 1. Tiles available in Structor version 2.*

In short, Structor 2 differs from Structor 1 only in the fact that the black and the white tiles now share the same tile pieces, which restricts the player in the number of possibilities of combining black and white tiles in his/her grid. Namely, in Structor 2, the sum of number of tiles type 0 and tiles type 1 cannot exceed 5, whereas in Structor 1, it could not exceed 10. This is the only difference between the two game versions.

We are now interested in calculating the number of possible configurations for both versions of this game, and thereby the probabilities that a certain pattern would ever repeat.