**THE DOOMED DICE CHALLENGE**

**SOLUTION**

**Part B**

Upon contemplating and reading the question,

**No. of Dices:** 2 (6 sided)

Values in dices range from 1 to 6

Thus,

Minimum combined sum = 1 + 1 = 2

Maximum combined sum = 6 + 6 = 12

Now, both the dice are doomed, that is all their face values becomes 0;

Original Dice\_A and Dice\_B = [1, 2, 3, 4, 5, 6]

**After Dooming,** Dice\_A = Dice\_B = [0, 0, 0, 0, 0, 0]

Now,

The task is to un-doom the dice, by finding out possible combinations for both dice A and dice B, such that the below constraints are addressed/satisfied:

**Constraints**

1. Die A cannot have face value exceeding 4
2. More than one face can have the same no. of spots (same face value)
3. Die B may have as many spots, even exceeding 6

The combination should be done in such a way that the original probability of the dice and the new undoomed dice must remain the same.

**Original Probabilities:**

**Probability = (No. of favorable outcomes / Total outcomes in sample space)**

For example

To find the probability of getting Sum = 2 when rolling both dice,

Now for getting **Sum value as 2**, the only possible dice outcome is

**Dice A = 1**

**Dice B = 1**

**Sum = 1+1 = 2**

P(Sum = 2) = (probability of getting 1 while rolling Dice A)\*(probability of getting 1 while rolling Dice B)

Now,

Probability of getting 1 in Dice A = (when outcome is 1/ total outcomes possible)

**P(1) = ⅙**

Similarly for Dice B also the probability of getting 1 is **⅙**

Thus, P(Sum = 2) = **⅙\*⅙ = 1/36 = 0.02777 = 2.77%**

Similarly finding all the probabilities we get **(For original dice A and B)**,

P(Sum = 2): 0.027777777777777776 = 2.78

P(Sum = 3): 0.05555555555555555 = 5.56

P(Sum = 4): 0.08333333333333333 = 8.33

P(Sum = 5): 0.1111111111111111 = 11.11

P(Sum = 6): 0.1388888888888889 = 13.89

P(Sum = 7): 0.16666666666666666 = 16.67

P(Sum = 8): 0.1388888888888889 = 13.89

P(Sum = 9): 0.1111111111111111 = 11.11

P(Sum = 10): 0.08333333333333333 = 8.33

P(Sum = 11): 0.05555555555555555 = 5.56

P(Sum = 12): 0.027777777777777776 = 2.78

**For solving this problem,**

We know that the minimum sum needs be 2 and maximum sum needs to be 12, just like in the original dice.

Thus, for maintaining the above consistency of sums, there should definitely be value 1 in both dice

Thus, we can conclude,

New\_Die\_A = [1, ?, ?, ?, ?, ?]

New\_Die\_B = [1, ?, ?, ?, ?, ?]

**Step 1:** So, we need to find out only the rest 5 missing values in each die, satisfying the constraints.

**Step 2:** Now we start iterating over all possible combinations for the dice A and B.

E.g.,

First 11 combinations of Dice A:

[[1, 1, 1, 1, 1, 1], [1, 1, 1, 1, 1, 2], [1, 1, 1, 1, 1, 3], [1, 1, 1, 1, 1, 4], [1, 1, 1, 1, 2, 2], [1, 1, 1, 1, 2, 3], [1, 1, 1, 1, 2, 4], [1, 1, 1, 1, 3, 3], [1, 1, 1, 1, 3, 4], [1, 1, 1, 1, 4, 4], [1, 1, 1, 2, 2, 2]]  
  
First 11 combinations of Dice B:

[[1, 2, 3, 4, 5, 6], [1, 2, 3, 4, 5, 7], [1, 2, 3, 4, 5, 8], [1, 2, 3, 4, 5, 9], [1, 2, 3, 4, 5, 10], [1, 2, 3, 4, 5, 11], [1, 2, 3, 4, 6, 7], [1, 2, 3, 4, 6, 8], [1, 2, 3, 4, 6, 9], [1, 2, 3, 4, 6, 10], [1, 2, 3, 4, 6, 11]]

**Step 3:** Going further we compare each possible combination from dice A with dice B, checking whether the probability of the new transformed values matches with the original probability of sums obtained from the original dice.

**Step 4:** If the condition is satisfied, the un-doomed combination will be returned by the un-doom function, along with probability values

**Step 5:** Else the search of elements continues until the conditions get exhausted.

**RESULT:**

Upon finding out the possible combination which satisfies the given constraint is,

**New\_Die\_A = [1, 2, 2, 3, 3, 4]**

**New\_Die\_B = [1, 3, 4, 5, 6, 8]**

(For probabilities refer output screenshot)

**Output:**

