

[illegible]

## Solving the scenario

To calculate the exact probability of 10 dice throws adding up to exactly the sum of 30, we must find

1. Count of total number of ways to achieve 30
2. Total number of all possible outcomes for 10 dices throws.

Total number of possible outcomes

1 dice  $\rightarrow 6^1$  (six sides)

So, there are 6 possible outcomes for each time one dice throws.

10 dice  $\rightarrow 6^{10}$

= 60 446 176

Counting all favorable outcomes

To calculate this, we must use a computational method as this involves large numbers.

### **Pseudocode:**

```
function count_combinations(n_dice, target_sum)
  if n_dice is 0
    if target_sum is 0
      return 1
    else
      return 0
  end if

  count = 0
  for i from 1 to 6
    count = count + count_combinations(n_dice - 1, target_sum - i)
  end for

  return count
```

end function

Code:

```
def count_combinations(n_dice, target_sum):  
    if n_dice == 0:  
        return 1 if target_sum == 0 else 0  
    count = 0  
    for i in range(1, 7):  
        count += count_combinations(n_dice-1, target_sum-i)  
    return count
```

Answer:

```
What is the probability that 10 dice throw add up exactly to 30
Answer:
All outcomes 6^6: 60466176
The all favourable outcomes:2930455
Process finished with exit code 0
```

## ▪ Favorable outcomes = 2 930 455

And to calculate this we use classical method probability finding formula to find the answer since dice all the outcomes are equally likely to happen.

$$P(E) = n(E) / n(S)$$

*n(S) is the number of elements in the sample space S and n(E) are the number of elements in the event E.*

$$P_{\text{sum}=30} = 2930465 / 60499176$$

The method used to calculate the probability of 10 dice throws adding up to 30 is classical probability method. The reasons for this are,

1. Equally likely outcomes: Each dice throws have equally likely outcomes.
2. The probability is calculated based on counting the number of favorable outcomes of the total, number of possible outcomes.
3. Don't rely on actual experiments or real-world data to determine the probability.

## Calculation

$$P(E) = n(E) / n(S)$$

$$P_{\text{sum}=30} = 2930465 / 60499176$$

$$P_{\text{sum}=30} = 0.048464367913724195$$

Round off

= 0.0485

***Pseudocode:***

favorable\_outcomes = count\_combinations(10, 30)

probability = favorable\_outcomes / (6 raised to the power of 10)

```
probability = favorable_outcomes / 6**10 # probability of favorable  
all outcomes of getting sum 30
```

```
The Probability of getting sum 30 :0.048464367913724195
```

```
Process finished with exit code 0|
```

To further confirm this result, we can count the unfavorable outcomes counts and calculate the possibility of getting a sum of 30 when throwing 10 fair dice independently.

***From previous computational calculations***

- Favorable outcomes = N
- All outcomes =  $6^6$
- Un-favorable Outcomes =  $6^6 - N$

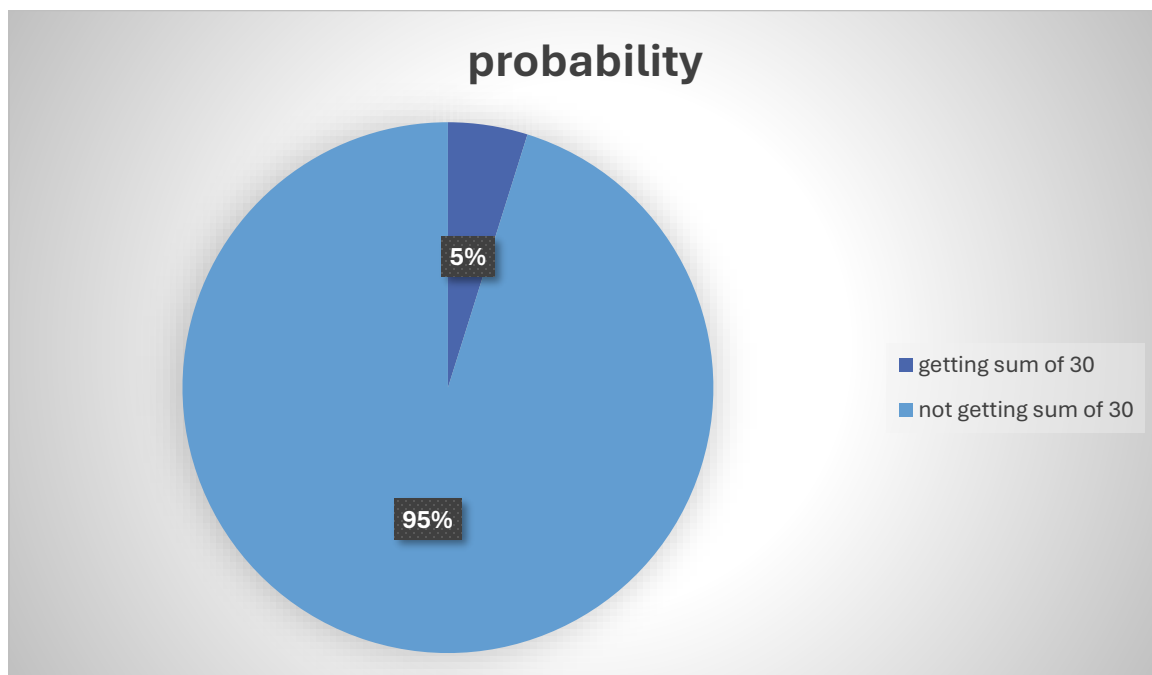
Probability of unfavorable outcomes = unfavorable outcomes count /  $6^6$

*Then*

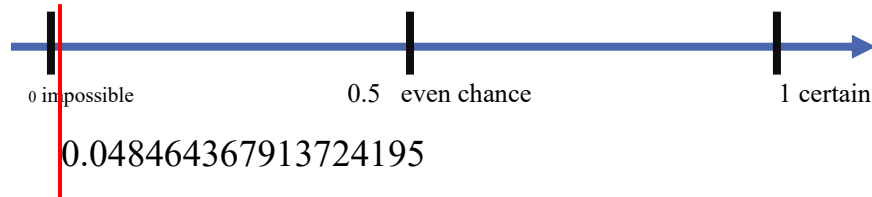
- All unfavorable Outcomes: 57535721
- The probability of not getting a sum of 30: 0.9515356320862758
- Sum of both probabilities  
= favorable probability + unfavorable probability  
=  $0.048464367913724195 + 0.9515356320862758$   
= 1

Probability of favorable outcomes + probability of unfavorable outcomes = 1

The sum of all probability in probability is always 1 and above calculation prove it.



Probability scale:



So, the scenario of 10 fair dice throws independently and getting 30 sum is near impossible limit of probability scale.

!!!! Should the entire code must be include in this report?

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