Lab 5

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In [19]:
```
import math
from itertools import combinations
import random
from itertools import product
```

Q1

A standard deck of 52 playing cards contains 12 face cards (J, Q, K), out of which 4 are Kings. Write a Python function to calculate P (King| FaceCard).

In [1]:
```
def P_King_FaceCard():
    king = 4
    face_card = 12
    return king / face_card

prob = P_King_FaceCard()
print(f"P(King | FaceCard) = {prob}")
```

```
P(King | FaceCard) = 0.3333333333333333
```

Q2

Write a Python function to simulate rolling two six-sided dice and compute: P(Sum=8)

In [2]:
```
def dice_probability():
    count = 0
    total = 0

    for die1 in range(1, 7):
        for die2 in range(1, 7):
            total += 1
            if die1 + die2 == 8:
                count += 1
    return count / total
prob = dice_probability()
print(f"P(Sum of 8) = {prob}")
```

```
P(Sum of 8) = 0.1388888888888889
```

Q3

A standard deck has 4 Aces out of 52 cards. If one card is drawn and not replaced, what is the probability of drawing two Aces in a row?

In [4]:
```
def prob_of_two_ace():
    first_ace = 4 / 52
    second_ace = 3 / 51
    return first_ace * second_ace

prob = prob_of_two_ace()
print(f"P(Drawing two Aces) = {prob}")
```

```
P(Drawing two Aces) = 0.004524886877828055
```

Q4

Write a function to calculate how many ways 4 books can be arranged on a shelf.

In [8]:
```
def four_books():
    return math.factorial(4)
num = four_books()
print(f"The number of ways to arrange 4 books on a shelf is: {num}")
```

```
The number of ways to arrange 4 books on a shelf is: 24
```

Q5

Write a function to compute the number of ways to choose 3 people from 10 for a committee

In [14]:
```
def choose_3_of_10():
    return len(list(combinations(range(10), 3)))

num = choose_3_of_10()
print(f"The number of ways to choose 3 people from 10 is: {num}")
```

```
The number of ways to choose 3 people from 10 is: 120
```

Q6

Write a function to compute the number of possible 5-letter passwords using 26 letters if i) Repetition is allowed and ii) Repetition is not allowed.

In [15]:
```python
def password_combination():
    #i) with reputition
    with_rep = 26 ** 5

    #ii) without reputition
    without_rep = math.perm(26, 5)

    return with_rep, without_rep

with_rep, without_rep = password_combination()

print(f"i) Number of 5-letter passwords with repetition: {with_rep}")
print(f"ii) Number of 5-letter passwords without repetition: {without_rep}")
```

```
i) Number of 5-letter passwords with repetition: 11881376
ii) Number of 5-letter passwords without repetition: 7893600
```

Q7

Simulate 3 fair coin tosses and compute the probability of getting at least one Heads.

In [20]:
```python
def sim_coin_toss():
    outcomes = list(product(['H', 'T'],repeat=3))
    total = len(outcomes)

    favorable = sum(1 for outcome in outcomes if 'H' in outcome)
    return favorable / total
prob = sim_coin_toss()
print(f"Probability of getting at least one Heads in 3 tosses: {prob}")
```

```
Probability of getting at least one Heads in 3 tosses: 0.875
```

Q8

A bag contains 5 red, 4 blue, and 3 green balls. Write a function to compute the probability of randomly selecting 2 red balls (without replacement) in two picks.

In [23]:
```python
def prob_of_2_reds():
    first_red = 5 / 12
    second_red = 4 / 11
    return first_red * second_red

prob = prob_of_2_reds()
print(f"Probability of selecting two red balls: {prob}")
```

```
Probability of selecting two red balls: 0.15151515151515152
```

Q9

A school has 200 students: 120 are male (80% pass) and 80 are female (90% pass). If a student is randomly selected and has passed, what is the probability that they are male?

In [26]:
```python
def prob_male_passed():
    total_students = 200
    male_students = 120
    female_students = 80

    male_pass_rate = 0.8
    female_pass_rate = 0.9

    passed_males = male_students * male_pass_rate
    passed_females = female_students * female_pass_rate
    total_passed = passed_males + passed_females

    return (passed_males / total_students) / (total_passed / total_students)

prob = prob_male_passed()
print(f"Probability that a randomly selected passing student is male: {prob}")
```

```
Probability that a randomly selected passing student is male: 0.5714285714285714
```

Q10

At a university, 60% of students are in science, and 40% are in Arts. The passing rate is: 90% for science and 70% for Arts. If a randomly selected student has passed, what is the probability they are from science? Use Bayes' theorem

In [28]:
```python
def prob_sci_pass():
    p_science = 0.6
    p_arts = 0.4
    p_pass_given_science = 0.9
    p_pass_given_arts = 0.7

    p_pass = (p_pass_given_science * p_science) + (p_pass_given_arts * p_arts)

    return (p_pass_given_science * p_science) / p_pass
prob = prob_sci_pass()
print(f"Probability that a randomly selected passing student is from Science: {prob}")
```

```
Probability that a randomly selected passing student is from Science: 0.6585365853658537
```

In [ ]: