# We will begin at 07:03 PM

Before this, let's review:

- Ma Cho has cooked 7 different curries. She wants to eat one for breakfast, one for lunch and one for dinner. She eats all of the curry in each meal. In how many different ways can she plan her meals for the day?

- Ko Oak has 10 different pens, and he wants to bring 3 to his class. In how many different ways can he make his selection?

- How many ways are there to arrange the letter of the word XXYYYZZZ?

# Some Housekeeping

- This is the last lesson, we will have the course-exam next Monday.
- Next homework is optional, but in case you did not get full points for the previous homeworks, you can get up to 50% of one typical homework by doing it.
- Next video is the review of what we have done throughout the course. We will solve various medium difficulty problems there.

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Lesson – 5

# Probability with Counting

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# The Game of Chance

You flip a fair coin. What are the chances of getting a head?

You roll a regular die.

- What are the chances of getting a 6?
- What are the chances of getting an even number?

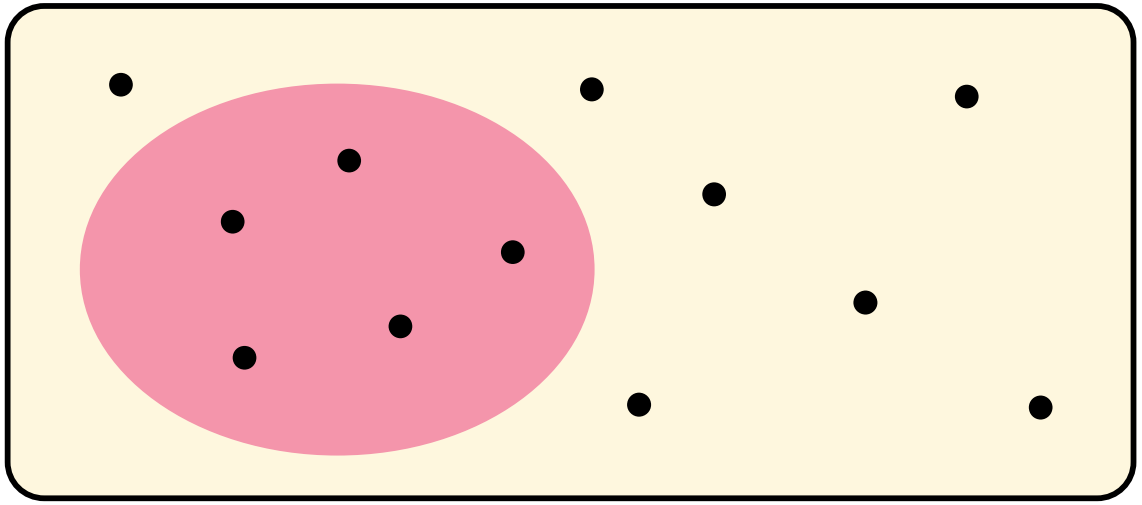
You flip two fair coins. What are the chances of getting two tails?

# Probability for Finite Possibilities

In an experiment, suppose that the number of possible outcomes is finite.

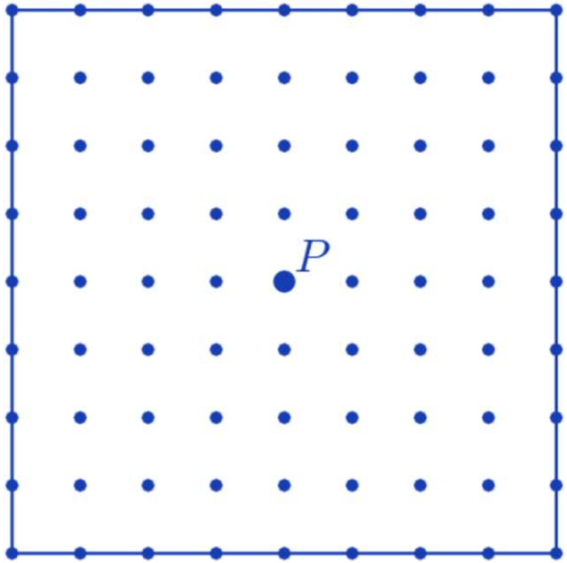
Suppose that you want a specific type of outcome. Then,

$$\text{Probability} = \frac{\text{Number of wanted outcomes}}{\text{Number of possible outcomes}}$$



# Q1. Line of Symmetry through P

There are 81 grid points (uniformly spaced) in the square shown in the diagram below, including the points on the edges. Point P is the center of the square. Given that point Q is randomly chosen from among the other 80 points, what is the probability that line PQ is a line of symmetry for the square?




Solution

Number of possible outcomes = 80.

Number of wanted outcomes = $4 \times 8 = 32$.

So, probability is $32/80 = 2/5$.

# Q2. Beach Party

On a beach, 50 people are wearing sunglasses and 35 people are wearing caps. Some people are wearing both sunglasses and caps. If one of the people wearing a cap is selected at random, the probability that this person is also wearing sunglasses is 0.4. If instead, someone wearing sunglasses is selected at random, what is the probability that this person is also wearing a cap?


Solution

Let x = number of people wearing both sunglasses and caps.

By given, x / 35 = 0.4.

Therefore, x = 14.

So, desired probability is 14/40 = 7/20.

# Q3. Than Zin's Favourite Music

Than Zin has saved 7 songs in her phone, one of which is her all time favourite. She picks three songs at random. What is the probability that one of these songs is her all time favourite?

# Q3. Than Zin's Favourite Music

Solution

Possible outcomes can be represented as a selection of 3 songs out of 7.

So, number of possible outcomes is $C_3^7 = 35$.

Wanted outcomes can be represented as a selection of 2 songs out of 6.

So, number of wanted outcomes is $C_2^6 = 15$.

So, probability is $\frac{15}{35} = \frac{3}{7}$.

# Q4. 5 Heads out of 7

Hein Min flipped a fair coin 7 times. What is the probability that he gets five heads and two tails?

Solution

We have to compute two things.

Number of possibilities = $2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 = 128$.

Wanted outcomes can be represented as permutation of 5 H's and 2 T's.

Number of wanted outcomes = $\frac{7!}{5! \times 2!} = 21$.

Therefore, probability = $\frac{21}{128}$

# Q5. Mg Gyi, Mg Latt, Mg Ngal

A bag has 2 blue, 2 white and 2 yellow marbles. Mg Gyi randomly takes two marbles from the bag. Then, from the remaining 2 marbles, Mg Latt randomly takes two marbles. Mg Ngal gets the remaining marbles. What is the probability that Mg Ngal's marbles have the same colour?

# Q5. Mg Gyi, Mg Latt, Mg Ngal

Solution

Possible outcomes can be represented as permutations of BBWWYY.

So, number of possible outcomes is $\frac{6!}{2! \times 2! \times 2!} = 90.$

Number of wanted outcomes has the form

_____BB or _____WW or _____YY.

So, number of wanted outcomes is $3 \times \frac{4!}{2! \times 2!} = 18.$

Therefore, probability is $\frac{18}{90} = \frac{1}{5}.$

Let's have a short break.

We will continue after 5 minutes.

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# Probability Principles

## Probability Subtraction Principle

Let X be any event. Then,

Probability of (NOT X) = 1 – Probability of X.

## Probability Addition Principle

Let X and Y be the sets of non-intersecting "events". Then,

Probability of (X or Y) = Probability of X + Probability of Y.

## Probability Multiplication Principle

Suppose an event Z is "obtained" by successively having event X and Y.

Suppose that the outcome of X does not affect probability of Y. Then,

Probability of Z = (Probability of X) $\times$ (Probability of Y).

# Q6. Round-robin Tennis

Three players A, B and C play a game of tennis with each other. The probability of A beating B is 1/2, that of B beating C is 1/3 and that of C beating A is 1/6. What is the probability that

(a) A wins both games?

(b) C loses both games?

(c) A wins both games and C loses both games?

# Q6. Round-robin Tennis

Solution

(a) P(A win both games)

= P(A wins B and A wins C)

= P(A wins B) × P(A wins C)

= 1/2 × 5/6

= 5/12.

(b) P(C loses both games)

= P(A wins C and B wins C)

= P(A wins C) × P(B wins C)

= 5/6 × 1/3

= 5/18.

# Q6. Round-robin Tennis

Solution

(c) P(A wins both and C loses both)

= P(A wins B) × P(A wins C) × P(B wins C)

= 1/2 × 1/3 × 5/6

= 5/36.

Wrong solution

P(A wins both and C loses both)

= P(A wins both) × P(C loses both)

= 5/12 × 5/18

= 25/216.

That's it for today.

Good luck with your preparations!

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