# PROBABILITY

**Experiment:** Whatever we do, is called experiment.

**Outcome:** Whatever is the result of the experiment is known as the outcome.

**Favourable Outcome:** The outcome in which we are interested is known as a favorable outcome.

**Total possible outcomes:** All possibilities related to the result of the experiment.

If one is aware with all the basic terms of probability, then the probability of any event/experiment can be found out by dividing the favourable outcome by total possible outcomes.

For example: Suppose we have a pack of cards and we want to pick a king of red then there will be less chance that we will pick out the same one. But let us find this quantitatively.

In this example: Experiment – Picking out one card from a pack of 52 cards.

Favourable outcome – Card picked out is red king (King of Heart or Diamond) (Only 2)

Total possible outcomes – Card picked out is any one of the total 52 cards.

**Probability = (Favourable outcome / Total possible outcomes)**

## Combination concept

Combination is also known as collection. Whenever we deal with probability questions, we use only **Combination** concept of ‘Permutation and Combination’. The reason is that in probability, we only have to collect or pick the things. We don’t arrange them after picking out. So once a student knows the basics of Combination can deal with probability questions in easy way.

The formula used for combination is $^{n}C_{r}$

$^{n}C_{r} = n! / [r! \times (n-r)!]$

$^{n}C_{r} = [n \times (n-1) \times (n-2) \times \ldots\ldots \times (n-r+1) \times (n-r) \times \ldots\ldots \times 1] / [1 \times 2 \times 3 \ldots\ldots \times r] \times [(n-r) \times \ldots\ldots 3 \times 2 \times 1]$

$^{n}C_{r} = [n \times (n-1) \times (n-2) \times (n-3) \ldots\ldots \times (n-r+1)] / [1 \times 2 \times 3 \ldots\ldots \times r]$

**For example:** $^{12}C_{2} = 12!/ [2! \times (12-2)!] = 12!/ (2! \times 10!) = [12 \times 11] / [1 \times 2] = 66$

$^{5}C_{2} = [5 \times 4] / [1 \times 2] = 10$

$^{n}C_{r} = {}^{n}C_{(n-r)}$

For example: $^{5}C_{3}$ = [5 x 4 x 3] / [1 x 2 x 3] = [5 x 4]/[1 x 2] = $^{5}C_{2}$ = 10

$^{10}C_{7}$ = $^{10}C_{3}$ = [10 x 9 x 8]/[1 x 2 x 3] = 120

# Various types of probability questions

Let us see how we can solve the probability questions, by taking the example of previous years questions asked in banking exams.

- **When the probability of two or more events is given: In this case, We use multiplication when both the events are going to happen (i.e. when the relation between the events is defined or described using 'and'). We use addition when only one of the events will happen (i.e. when the relation between the events is defined or described using 'or').**

**Two people A and B go for an interview, the probability of A clearing the interview is 1/2 and probability of B clearing the interview is 1/4.**

**Q-1) What is the probability that both A and B will clear the interview?**

**Solution:** We will multiply the probability of happening of both the events.

(1/2) x (1/4) = 1/8

**Q-2) What is the probability that either one of them will clear the interview?**

**Solution:** We will add the probability of happening of both the events.

(1/2) + (1/4) = 3/4

**Q-3) What is the probability that only A will clear the interview?**

**Solution:** We will multiply the probability of happening of event A and non-happening of event B.

(1/2) x [1-(1/4)] = (1/2) x (3/4) = 3/8

Note: Probability of non-happening of an event is always found out by subtracting probability of happening of that event from 1. The reason is that an event may or may not take place. So probability of happening of the event and non-happening of the event always add up to 1.

**Probability of non-happening of an event = 1 – (Happening of an event)**

**Q-4) What is the probability that only B will clear the interview?**

**Solution:** We will multiply the probability of non-happening of event A and happening of event B.

$[1-(1/2)] \times (1/4) = (1/2) \times (1/4) = 1/8$

- **When we have to choose or pick out things from a bag/group: In this case, we use the concept of combination because we are choosing (selecting) things.**

**A bag contains 6 red shirts, 6 green shirts and 8 blue shirts.**

**Q-5) Two shirts are drawn randomly. What is the probability that both are green?**

**Solution:** Favourable outcome – 2 Green shirts (out of 6)

Total possible outcomes – 2 shirts (out of 20)

**Probability =** ${}^{6}C_{2}/{}^{20}C_{2} = [(6\times5) / (1\times2)]/ [(20\times19)/(1\times2)] = (6\times5)/(20\times19) =$ **3/38**

**Q-6) Three shirts are drawn randomly. What is the probability that two are blue and one is red?**

**Solution**: Favourable outcome – 2 blue (out of total 8) ***and*** 1 red shirt (out of total 6)

Total possible outcomes – 3 (out of 20)

**Probability =** $({}^{8}C_{2} \times {}^{6}C_{1})/ {}^{20}C_{3} = (28\times6)/1140 =$ **14 / 95**

Because we have ‘AND’ in favourable outcome, so we used multiplication.

**Q-7) Two shirts are drawn randomly. What is the probability that both are either red or blue?**

**Solution:** Favourable outcome – 2 red (out of total 6) *or* 2 blue (out of total 8)

Total possible outcomes – 2 (out of 20)

**Probability** = $({}^{6}C_{2}+{}^{8}C_{2})/ {}^{20}C_{2} = (15+28)/190 =$ **43/190**

Because we have ‘OR’ in favourable outcome, so we used addition.

**Q-8) Out of 5 girls and 3 boys, 4 children are to be randomly selected for a quiz contest. What is the probability that all the selected children are girls?**

**Solution:** Favourable outcome – 4 (out of 5)

Total possible outcomes – 4 (out of 8)

**Probability** = ${}^{5}C_{4}/{}^{8}C_{4} = {}^{5}C_{1}/{}^{8}C_{4} = 5/70 =$ **1/14**

- **When dice are thrown: Concept of combination is not needed in these questions. We normally check the favourable and total possible outcomes by the basic idea of**

**a dice. The total possible outcomes are decided on the basis of no of throws or no of dices used. If two throws are made (or two dices are thrown) then the total possible outcomes can be found out by 6 x 6 = 36 (because these are the total possible combinations which can be seen).**

**Q-9) A die is thrown twice. What is the probability of getting a sum 7 from both the throws?**

**Solution:** Favourable outcome – 6 [(1,6),(2,5),(3,4),(4,3),(5,2),(6,1)]

Total possible outcomes – 6x6 = 36

Probability = 6/36 = **1/6**

**Q-10) A die is thrown thrice. What is the probability of getting a sum 5?**

**Solution:** Favourable outcomes – 6[(1,1,3),(1,3,1),(3,1,1),(1,2,2),(2,1,2),(2,2,1)]

Total possible outcomes – 6x6x6 = 216

Probability = 6/216 = **1/36**

- **When cards are chosen from a pack of cards: Here we use the concept of combination because we are choosing (selecting) cards from a whole pack of cards. The total possible outcomes are 52 if only one pack of cards is used.**

**Q-11) Two cards are picked simultaneously from a pack of cards. What is the probability that both the cards will be queen?**

**Solution:** Favourable outcomes – 2 (out of 4)

Total possible outcomes – 2 (out of 52)

Probability = ${}^{4}C_2/{}^{52}C_2$ = [(4x3)/(1x2)]/[(52x51)/(1x2)] = (4x3)/(52x51) = **1/221**

**Q-12) Two cards are picked out one by one from a pack of cards with replacement. What is the probability that both the cards will be queen?**

**Solution: First pick out –**

Favourable outcomes – 1 (out of 4)

Total possible outcomes – 1 (out of 52)

Probability = ${}^{4}C_1/{}^{52}C_1$ = 4/52 = 1/13

**Second pick out –**

Favorable outcome – 1 (out of 4)

Total possible outcomes – 1 (out of 52)

Probability = $^{4}C_{1}/^{52}C_{1}$ = 4/52 =1/13

Because both events are happening, so final probability = (1/13) x (1/13) = **1/169**

**Q-13) Two cards are picked out one by one from a pack of cards without replacement. What is the probability that both the cards will be queen?**

**Solution: First pick out –**

Favourable outcomes – 1 (out of 4)

Total possible outcomes – 1 (out of 52)

Probability = $^{4}C_{1}/^{52}C_{1}$ = 4/52 = 1/13

**Second pick out –**

Favourable outcome – 1 (out of 3)

Total possible outcomes – 1 (out of 51)

Probability = $^{3}C_{1}/^{51}C_{1}$ = 3/51 = 1/17

Because both events are happening, so final probability = (1/13) x (1/17) = **1/221**

- **When team/group/committee is made with some constraints: In these questions, we have to find out the probability of different possibilities and we add those probabilities because only one combination of team/group/committee will be formed at a time.**

**A committee of 3 members is to be made out of 3 men and 2 women.**

**Q-14)What is the probability that the committee has at least one woman?**

**Solution:** Favourable outcomes – [1(out of 2 women) and 2(out of 3 men)]

Or [2(out of 2 women) and 1(out of 3 men)]

Total possible outcomes – 3 (out of 5)

Probability = $[(^{2}C_{1}x^{3}C_{2}) + (^{2}C_{2}x^{3}C_{1})] / {}^{5}C_{3}$ = [(2x3) + (1x3)] / 10 = (6+3)/10 = **9/10**

**Q-15) What is the probability that the committee has at most one woman?**

**Solution:** Favourable outcomes – [0(out of 2 women) and 3(out of 3 men)]

Or [1(out of 2 women) and 2(out of 3 men)]

Total possible outcomes – 3 (out of 5)

Probability = $[({}^{2}C_{0} x {}^{3}C_{3}) + ({}^{2}C_{1} x {}^{3}C_{2})] / {}^{5}C_{3}$ = (1+6)/10 = **7/10**