**Marble, Balls & Cards based scenario Probability questions for Data Science Interview**

1. **A jar contains 30 red marbles, 12 yellow marbles, 8 green marbles and 5 blue marbles. What are the probability that you draw and replace marbles 3 times and you get NO red marbles?**

* There are 55 marbles, 25 of which are not red
* P(getting a colour other than red) = P(25/55) ≈ 0.455
* The probability of this happening 3 times in a row is

found by 0.455\*0.455\*0.455≈ 0.094

1. **A jar contains 30 red marbles, 12 yellow marbles, 8 green marbles and 5 blue marbles. What are the probability that you draw and replace marbles 3 times and you get at least 1 Red?**

* It's easier to calculate the probability of getting NO red marbles, and subtract that from 1 (we use the complement rule : P(AC) = 1 – P(C)
* From the previous example, it is 1 - 0.094 = 0.906

1. **A jar contains 30 red marbles, 12 yellow marbles, 8 green marbles and 5 blue marbles. You draw and replace marbles 3 times. What is the probability the third marble is the first red marble?**

* This means the first two are not red. We calculated

P(drawing a non-red) =0 .455. Therefore, P(red)=0.545

* P(non-red & non-red & Red) = P(non-red) \* P(nonred) \* P(red) = 0.455 \* 0.455 \* 0.545 = 0.113

1. **A jar contains 30 red marbles, 12 yellow marbles, 8 green marbles and 5 blue marbles. You draw and replace marbles 3 times. What is the probability you draw 1 Red, 1 Yellow, and 1 Blue?**

* This is harder because we are drawing marbles in an order, but we don't care about which order we get Red, Yellow and Blue, just that there is 1 of each.
* Let RBY = “Draw a Red, then Blue, then Yellow”
* So all disjoint events we want to consider are: RBY, RYB, YRB, YBR, BYR, BRY
* P(RBY) = P(R)\*P(B)\*P(Y) = (30/55)\*(5/55)\*(12/55) = 0.0108
* But we have 6 disjoint cases. Because each one is calculated as a product of the three, and each disjoint case has the same probability (each order is equally likely), our answer is 6\*0.0108 = 0.0649

1. **A bag contains three green marbles, four blue marbles, and two orange marbles. If a marble is picked at random, then find the probability that it is not an orange marble.**

* Number of green marbles = n(G) = 3
* Number of blue marbles = n(B) = 4
* Number of orange marbles = n(O) = 2
* Total number of marbles n(S) = n(G) + n(B) + n(O) = 3 + 4 + 2 =9
* The probability that it is not an orange marble is only when there is only green and blue marble, Total number of favourable cases = 3 + 4 = 7
* P(not an orange ball)= 7/9

1. **A jar contains 10 red marbles, 4 white marbles, and 2 blue marbles. Two are drawn in sequence, not replacing after each draw.**
2. **The probability of drawing two red marbles**
3. **The probability of drawing exactly one blue marble.**
4. Note that there are 16 total marbles. A is simply a set of sequential events. On the first, you have 10/16 chances to draw a red. Supposing this red is not replaced, the chance of drawing a second red will be 9/15; therefore, the probability of A is (10/16) \* (9/15) = 0.375.
5. 2 possible events: Blue + (White or Red) or (White or Red) + Blue. The probabilities of each of these events, added together would be (2/16) \* (14/15) + (14/16) \* (2/15) = 0.2333333333;
6. **In a bowl containing 10 marbles, 5 are blue and 5 are pink. If 2 marbles are picked randomly, what is the probability that the 2 marbles will not both be pink?**

* To solve this question, you can solve for the probability of choosing 2 marbles that are pink and subtracting that from 1 to obtain the probability of selecting any variation of marbles that are not both pink.
* The probability of picking 2 marbles that are both pink would be the product of the probability of choosing the first pink marble multiplied by the probability of choosing a second pink marble from the remaining marbles in the mix.
* This would be 1/2 \* 4/9 = 2/9.
* To obtain the probability that is asked, simply compute 1 – (2/9) = 7/9.

1. **Box A has 10 green balls and 8 black balls. Box B has 9 green balls and 5 black balls. What is the probability if one ball is drawn from each box that both balls are green?**

* Note that drawing balls from each box are independent event. Thus their probabilities can be combined with multiplication.
* Probability of drawing green from A:10/18 = 5/9
* Probability of drawing green from B: 9/14
* So:5/9 \* 9/14 = 5/14

1. **a is chosen randomly from the following set:**

**{3, 11, 18, 22}**

**b is chosen randomly from the following set:**

**{ 4, 8, 16, 32, 64, 128}**

**What is the probability that a + b = 27?**

* Since any of the first sets can be summed with any of the second sets, the addition sign in the equation works like a conjunction. As such, there are 4 \* 6 = 24 possible combinations of a and b. Only one of these combinations, 11 + 16 = 27, works. Thus the probability is 1/24, or about 0.04.

1. **In a bag, there are 10 red, 15 green, and 12 blue marbles. If you draw two marbles (without replacing them), what is the approximate probability of drawing two different colours?**

* Calculate the chance of drawing either 2 reds, two greens, or two blues. Then, subtract this from 1 (100%) to calculate the possibility of drawing a pair of different colours.
* The combined probability of RR, GG, and BB is: (10 \* 9) / (37 \* 36) + (15 \* 14) / (37 \* 36) + (12 \* 11) / (37 \* 36)
* This simplifies to: (90 + 210 + 132) / 1332 = 432 / 1332
* Subtract from 1: 1 - 432 / 1332 = (1332 - 432) / 1332 = approx. 0.6757 or 67.57%

1. **There are four aces in a standard deck of playing cards. What is the approximate probability of drawing two consecutive aces from a standard deck of 52 playing cards?**

* The probability of two consecutive draws without replacement from a deck of cards is calculated as the number of possible successes over the number of possible outcomes, multiplied together for each case.
* Thus, for the first ace, there is a 4/52 probability and for the second there is a 3/51 probability. The probability of drawing both aces without replacement is thus 4/52\*3/51, or approximately .005.

1. **A card is drawn from a well-shuffled pack of 52 cards. Find the probability of:**

**(i)‘2’ of spades**

**(ii) a jack**

**(iii) a king of red colour**

**(iv) a card of diamond**

**(v) a king or a queen**

**(vi) a non-face card**

**(vii) a blackface card**

**(viii) a black card**

**(ix) a non-ace**

**(x) non-face card of black colour**

**(xi) neither a spade nor a jack**

**(xii) neither a heart nor a red king**

* In a playing card, there are 52 cards.
* Therefore the total number of possible outcomes = 52

(i) ‘2’ of spades:

* A number of favourable outcomes i.e. ‘2’ of spades is 1 out of 52 cards.
* Therefore, the probability of getting ‘2’ of spade
* P(A) = (Number of favorable outcomes/Total number of possible outcome) = 1/52

(ii) a jack

* Number of favourable outcomes i.e. ‘a jack’ is 4 out of 52 cards.
* Therefore, probability of getting ‘a jack’
* P(B) = (Number of favourable outcomes/Total number of possible outcome) = 4/52= 1/13

(iii) a king of red colour

* Number of favourable outcomes i.e. ‘a king of red colour’ is 2 out of 52 cards.
* Therefore, probability of getting ‘a king of red colour’
* P(C) = ( Number of favourable outcomes/Total number of possible outcome) = 2/52

= 1/26

(iv) a card of diamond

* Number of favourable outcomes i.e. ‘a card of diamond’ is 13 out of 52 cards.
* Therefore, the probability of getting ‘a card of diamond’
* P(D) = ( Number of favourable outcomes/Total number of possible outcomes)= 13/52

= 1/4

(v) a king or a queen

* Total number of king is 4 out of 52 cards.
* Total number of queen is 4 out of 52 cards
* Number of favourable outcomes i.e. ‘a king or a queen’ is 4 + 4 = 8 out of 52 cards.
* Therefore, probability of getting ‘a king or a queen’

P(E) = 8/52 = 2/13

(vi) a non-face card

* Total number of face card out of 52 cards = 3 times 4 = 12
* Total number of non-face card out of 52 cards = 52 - 12 = 40
* Therefore, probability of getting ‘a non-face card’
* P(F) = 40/52= 10/13

(vii) a black face card:

* Cards of Spades and Clubs are black cards.
* Number of face card in spades (king, queen and jack or knaves) = 3
* Number of face card in clubs (king, queen and jack or knaves) = 3
* Therefore, total number of black face card out of 52 cards = 3 + 3 = 6
* Therefore, probability of getting ‘a black face card’
* P(G) = 6/52 = 3/26

(viii) a black card:

* Cards of spades and clubs are black cards.
* Number of spades = 13
* Number of clubs = 13
* Therefore, total number of black card out of 52 cards = 13 + 13 = 26
* Therefore, probability of getting ‘a black card’
  + P(H) = 26/52= 1/2

(ix) a non-ace:

* Number of ace cards in each of four suits namely spades, hearts, diamonds and clubs = 1
* Therefore, total number of ace cards out of 52 cards = 4
* Thus, total number of non-ace cards out of 52 cards = 52 - 4 = 48
* Therefore, probability of getting ‘a non-ace’
  + P(I) = 48/52 = 12/13

(x) non-face card of black colour:

* Cards of spades and clubs are black cards.
* Number of spades = 13
* Number of clubs = 13
* Therefore, total number of black card out of 52 cards = 13 + 13 = 26
* Number of face cards in each suits namely spades and clubs = 3 + 3 = 6
* Therefore, the total number of non-face card of black colour out of 52 cards = 26 - 6 = 20
* Therefore, probability of getting ‘non-face card of black colour’
  + P(J) = 20/52 = 5/13

(xi) neither a spade nor a jack

* Number of spades = 13
* Total number of non-spades out of 52 cards = 52 - 13 = 39
* Number of jack out of 52 cards = 4
* Number of jack in each of three suits namely hearts, diamonds and clubs = 3
* [Since, 1 jack is already included in the 13 spades so, here we will take number of jacks is 3]
* Neither a spade nor a jack = 39 - 3 = 36
* Therefore, probability of getting ‘neither a spade nor a jack’
  + - P(K) =36/52 = 9/13

(xii) neither a heart nor a red king

* Number of hearts = 13
* a Total number of non-hearts out of 52 cards = 52 - 13 = 39
* Therefore, spades, clubs and diamonds are the 39 cards.
* Cards of hearts and diamonds are red cards.
* Number of red kings in red cards = 2
* Therefore, neither a heart nor a red king = 39 - 1 = 38
* [Since, 1 red king is already included in the 13 hearts so, here we will take a number of red kings is 1]
* Therefore, probability of getting ‘neither a heart nor a red king’
  + P(L) = 38/52 = 19/26

1. **A card is drawn at random from a well-shuffled pack of cards numbered 1 to 20. Find the probability of**

**(i) getting a number less than 7**

**(ii) getting a number divisible by 3.**

(i) a Total number of possible outcomes = 20 ( since there are cards numbered 1, 2, 3, ..., 20).

* A number of favourable outcomes for the event E= number of cards showing less than 7 = 6 (namely 1, 2, 3, 4, 5, 6).
* So, P(E) = ( Number of Favourable Outcomes for the Event E/Total Number of Possible Outcomes)= 6/20 = 3/10

.

(ii) Total number of possible outcomes = 20.

* A number of favourable outcomes for the event F = number of cards showing a number divisible by 3 = 6 (namely 3, 6, 9, 12, 15, 18).
* So, P(F) = (Number of Favourable Outcomes for the Event F/Total Number of Possible Outcomes)= 6/20 = 3/10

.

1. **. A card is drawn at random from a pack of 52 playing cards. Find the probability that the card drawn is**

**(i) a king**

**(ii) neither a queen nor a jack.**

* Total number of possible outcomes = 52 (As there are 52 different cards).

(i) Number of favourable outcomes for the event E = number of kings in the pack = 4.

* So, by definition, P(E) = 4/52= 1/13

(ii) Number of favourable outcomes for the event F

= a number of cards which are neither a queen nor a jack

= 52 - 4 - 4, [Since there are 4 queens and 4 jacks].= 44

* Therefore, by definition, P(F) = 44/52 = 11/13

***Source:***

* <https://www.math-only-math.com/playing-cards-probability.html>