MANSOURA UNIVERSITY

FACULTY OF COMPUTERS AND INFORMATION

Probability and Statistics Homework 2

Second Semester – 2022/2023 First Level

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Solve the following problems:

1) How many ways can 12 students in a class take 3 different tests if 4 students are to take each test?

Answer:

First group: C (12, 4) = 495 ways.

8 students left.

second group: C (8, 4) = 70 ways.

4 students left.

last group is already determined in only one way

The Number of ways is:

495 x 70 x 1 = 34,650 way

Solve the following problems:

2) Construct the tree diagram for the number of permutations of (a, b, c}.

Answer:

{a, b, c}

3) Consider two items selected randomly from a box that contains 12 items. Of these 12 items, 4 items are defective. If A is the event represents that both the tow items are defective” while B represents that “both the two items are non-defective”

I) Find P(A) and P(B).

Answer:

P(A)

probability of selecting a defective item on the first draw is 4/12 = 1/3.

probability of selecting another defective item on the second draw is 3/11.

the probability of both items being defective is:

P(A) = (1/3) \* (3/11) = 1/11

P(B)

probability of selecting a non-defective item on the first draw is 8/12 = 2/3.

probability of selecting another non-defective item on the second draw is 7/11.

the probability of both items being non-defective is:

P(B) = (2/3) \* (7/11) = 14/33

3) Consider two items selected randomly from a box that contains 12 items. Of these 12 items, 4 items are defective. If A is the event represents that both the tow items are defective” while B represents that “both the two items are non-defective”

ii) Find P (at least one item is defective)?

Answer:

probability of event B :

P(B) = (8/12) \* (7/11) = 28/66

the probability of the complement of event B= which is event A:

P(A) = 1 - P(B) = 1 - 28/66 = 38/66=19/33

4) A box contains three 15 items of which five are defective. If three items are chosen at random from this box, find the probability that:

(I) none of the three selected items are defective?

Answer:

C(4, 2) = 4! / (2!(4-2)!) = 6

There are a total of C(12, 2) ways to choose 2 items from the box of 12 items:

C(12, 2) = 12! / (2!(12-2)!) = 66

the probability of event A (P(A)) is :  
P(A) = 6 / 66 = 1 / 11

For event B (both items are non-defective), there are 8 non-defective items in the box (12 - 4).

C(8, 2) = 8! / (2!(8-2)!) = 28

The probability of event B (P(B)) is:

P(B) = (number of favorable outcomes for B) / (total number of outcomes)  
P(B) = 28 / 66 = 14 / 33

So the probabilities are:

P(A) = 1/11  
P(B) = 14/33

4) A box contains three 15 items of which five are defective. If three items are chosen at random from this box, find the probability that:

(ii) exactly one item of the three items is defective?

Answer:

The total number of possible outcomes:

C(15,3) = 15! / (3! \* (15-3)!) = 455

l the number of ways to choose one defective item and two non-defective item.

= C(5,1) \* C(10,2)

= 5 \* (10! / (2! \* (10-2)!))

= 225

the probability of exactly one item of the three items being defective is:

P(exactly one item is defective) = 225 / 455

4) A box contains three 15 items of which five are defective. If three items are chosen at random from this box, find the probability that:

(iii) at least one item of the three items is defective?

Answer:

the probability of none of the three items being defective:

C(10,3) = 10! / (3! \* (10-3)!) = 120

probability of choosing three non-defective items is:

P(choosing three non-defective items) = 120 / C(15,3) = 120 / 455

the probability of at least one item of the three items being defective is:

P(at least one item being defective) = 1 - P(choosing three non-defective items)  
= 1 - (120 / 455)  
= 335 / 455

5) A class contains 10 boys and 20 girls of which half the boys and half the girls have from Mansoura.

Find the probability that a person chosen randomly is a boy or from Mansoura university?

Answer:

Number of boys from Mansoura = 10 / 2 = 5

Number of girls from Mansoura = 20 / 2 = 10

the total number of people from Mansoura is:

5 + 10 =15

The probability of choosing a boy randomly is:

P(boy) = 10 / 30 = 1/3

The probability of choosing a person from Mansoura university is:

P(from Mansoura) = 15 / 30 = 1/2

the probability of choosing a boy from Mansoura is:

P(boy from Mansoura) = 5 / 30 = 1/6

the probability of a person chosen randomly being a boy or from Mansoura university is:

P(boy or from Mansoura) = 1/3 + 1/2 - 1/6  
= 5/6

6) Let A and B be events with P(A)= 3/8, P(B)= 1/2 and P(A intersection B)= 1/2;.

Find

(i) P(Ac )

Answer:

P(A') = 1 - 3/8 = 5/8

(ii) P(Bc )

Answer:

P(B') = 1 - ½ = 1/2

(iii) P(A c intersection B c ),

Answer:

(A' intersection B') = 1 - P(A intersection B)

= 1 - 1/2

= 1/2

P(A' union B) = 1 - P(A' intersection B')

= 1 - 1/2

= 1/2

SO the probability of either A or B occurring is 1/2 or 0.5.

the probability of (A' intersection B') :

P(A' intersection B') = 1 - P(A' union B)

= 1 - 1/2

= 1/2

7) When you are rolling a pair of (fair) dice three times.

What is the probability that, least one of the three tries, you roll a 7?

Answer:

the probability of rolling a sum of 7 on any given try :

6/36 = 1/6.

P(no sum of 7) = (5/6)^3  
= 125/216

the probability of at least one try resulting in a sum of 7 is:

P(at least one sum of 7) = 1 - P(no sum of 7)  
= 1 - 125/216  
= 91/216

8) If Σ P(x) = k^2 – 8,

Find the value of k?

Answer:

Since

the sum of probabilities for all possible values of x must equal 1:

Σ P(x) = 1

Then

k^2 - 8 = 1

k^2 = 9

k = ±3

9) If A and B are mutually exclusive events, P(A)=0.35 and P(B)=0.45

Find P(A′ ∩ B′).

Answer:

P(A' intersection B') = 1 - P(A union B)

P(A union B) = P(A) + P(B)

P(A union B) = 0.35 + 0.45 = 0.8

the probability of the complement of A union B is:

P(A' intersection B') = 1 - P(A union B)  
= 1 - 0.8 = 0.2