**STATISTICS**

**ASSIGNMENT (PROBABILITY)**

**Solve at least 3 exercises.**

**EXERCISE 1.**

Answer the following questions by calculating the number of ways of obtaining particular arrangements of objects and events.

1. An athlete has eight different trophies, but only has room for four trophies in a display cabinet. How many different ways is it possible to display just four trophies out of eight, assuming that the display order is important?

**If the order is important we should use permutation. = (8! / 4!) = 1,680**

**He/she can display his/her trophies in 1680 different ways.**

1. A football manager has a squad of 20 players. How many different teams of 11 players could be selected from the squad? (Hint: Assume that positions of the players are not important)

**If the order is not important we should use combination. = (20! / (11! \* 9!))=167,960**

**He/she can select his/her players in 167,960 different ways.**

**EXERCISE 2.**

Are people happy in their marriages? The table shows results from the 2008 General Social Survey for married adults classified by gender and level of happiness.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Gender** | **Very Happy** | **Pretty Happy** | **Not too Happy** | ***Total*** |
| Male | 183 | 243 | 43 | ***469*** |
| Female | 215 | 247 | 38 | ***500*** |
| ***Total*** | ***398*** | ***490*** | ***81*** | ***969*** |

1. Estimate the probability that a married adult is very happy.

**It doesn't matter if it's a male or a female, so we have to calculate from the total.**

**398/969 = 0.41 = %41**

1. Estimate the probability that a married adult is very happy,   
   (i) given that their gender is male and   
   (ii) given that their gender is female.

**i. 183/469 = 0.39 = %39**

**i. 215/500 = 0.43 = %43**

1. For these subjects, are the events being very happy and being a male independent?

**No, gender and happiness are dependent variables. Because when the very happy person is female, the probability will differ if it is male.**

**EXERCISE 3.**

The Triple Blood Test screens a pregnant woman and provides as estimated risk of her baby being born with the genetic disorder Down syndrome. A study of 5282 women aged 35 or over analyzed the Triple Blood Test to test its accuracy.

A contingency table for Triple Blood Test of Down syndrome shown below.

|  |  |  |  |
| --- | --- | --- | --- |
| **Down** | **POS** | **NEG** | ***Total*** |
| D (Down) | 48 | 6 | ***54*** |
| Dc (unaffected) | 1307 | 3921 | ***5228*** |
| ***Total*** | ***1355*** | ***3927*** | ***5282*** |

**Correct | False Positive**

**False Negative | Correct**

1. Given that a test result is negative, show that the probability the fetus actually has Down syndrome is P(D | NEG) = 0.0015.

**P(D | NEG) = 6/3927 = 1.5 \* 10-3 = 0.0015**

1. Is P(D | NEG) equal to P(NEG | D)? If so, explain why. If not, find P(NEG | D).

**P(D | NEG) = (P(D) \* P(NEG | D)) / P(NEG) = 0.0015**

**P(NEG | D) = (P(NEG) \* P(D | NEG)) / P(D) = 6/54 = 0.11**

**P(D | NEG) =? (P(NEG \* P(D | NEG)) / P(D)**

**P(D) =? P(NEG)**

**54 ≠ 3927**

**As we can see from the formula and the calculation, “P(NEG | P)” and “P(D | NEG)” are not equal. Because “the given probability the fetus actually has Down syndrome” and “given that a test result is negative probabilities” are different from each other.**

**EXERCISE 4.**

Males and females are observed to react differently to a given set of circumstances. It has been observed that 70% of the females react positively to these circumstances, whereas only 40% of males react positively -. A group of 20 people, 15 female and 5 male, was subjected to these circumstances, and the subjects were asked to describe their reactions on a written questionnaire. A response picked at random from the 20 was negative. What is the probability that it was that of a male?

**15 Female;**

**Count of the females who is react positively to these circumstances: 15 \* (%70) = 10.5**

**5 Male;**

**Count of the males who is react positively to these circumstances: 5 \* (%40) = 2**

**Total: 20 female and male**

**Probability of the being negative and being male**

**((4.5+3)/20) \* (5/20) = 0.09 = %9**