**Statistics - Assignment 5 (Probability)**

**EXERCISE 1.**Answer the following questions by calculating the number of ways of obtaining arrangements of objects and events.

**Solution 1 – ordering of 4 trophies out of 8.**

This is a case of permutation.

The formula for permutation is

**Solution 2 - teams of 11 players out of 20.**

This is a case of combination, as positions are not important.

The formula for the number of combinations is

**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.

1. Estimate the probability that a married adult is very happy:
2. Estimate the probability that a married adult is very happy,
3. given that their gender are male:

VH: very happy, M: Male

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1. given that their gender are female:

VH: very happy, F: Female

=

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

The table shows that level of happiness and gender are dependent factors.

**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.

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

D:Down, NEG: Negative

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

No, they are not expected to be equal. Although P(D and NEG) and P(NEG and D) are equal to eah other, the denominators (the given parts) are not equal. To prove it:

**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 males, 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?

N: negative response, F:Female, M: Male

P(M) = 5/20 = ¼ P(F) = ¾ P(N|M) = 1 – 0.4 = 0.60 P(N|F) = 1 – 0.70 =0.30 P(N) = 1 – (0.7\*15 + 0.4\*5)/20 = 0.375

According to the Bayes’ rule: