**STAT 351 – Homework 2  - Due by 11.59 pm on Thursday, April 15**

**You are encouraged to work on this assignment in groups. However, you cannot write exactly same explanations.**

**If I see the exact same explanation on two or more assignments, then I’ll give zero points for those assignments.**

**Show your work before the final answer appropriately to get full points.**

**Problem 1:**

In a group of 50 students, 12 take neither English nor chemistry, 24 take English and 20 take chemistry. You may use a Venn diagram to answer for this question.

a) What is the probability that a student chosen at random from this group takes English or chemistry?

b) What is the probability that a student chosen at random from this group takes both English and chemistry?

c) What is the probability that a student chosen at random from this group takes chemistry but not English?

d) Given that a student chosen at random from this group takes English, what is the probability that this student takes chemistry?

**Problem 2:**

We roll two fair 6-sided dice. Each one of the 36 possible outcomes is assumed to be equally likely.

(a) Find the probability that at least one die roll is a 5.

(b) Given that the roll results in a sum of 10, find the conditional probability that at least one die roll is a 5.

**Problem 3:**

Sixteen parts are examined for defects. It is found that 11 are good, 3 have minor defects, and 2 have major defects.

(a) What is the probability that a randomly selected one part is good?

(b) Two parts are chosen at random from the 16 parts without replacement (that is, the first part chosen is not returned to the mix before the second part is chosen). Notice, then, that there will be only 15 possible choices for the second part. You may use a tree diagram for this problem.

(i) What is the probability that both are good?

(ii) What is the probability that exactly one part has a major defect? (You may use the tree diagram to find out all possible outcomes) Keep 3 or more decimal places if you simplify your answer.

**Problem 4:**

A certain factory operates three different shifts. Over the last year, several accidents have occurred at the factory. Some of these can be attributed at least in part to unsafe working environments, whereas the others are unrelated to working environments. The accompanying table gives the percentage of accidents falling in each type of accident–shift category.

|  |  |  |  |
| --- | --- | --- | --- |
|  |  | Unsafe Environments | Unrelated to Environments |
| Shift | Day | 8% | 35% |
| Swing | 10% | 20% |
| Night | 5% | 22% |

Suppose one of the several accident reports is randomly selected from a file of report, and the shift and type of accident are determined.

(a) Compute the probability that the selected accident will occur on the day shift.

(b) Compute the probability that the selected accident will not occur on the day shift.

(c) Compute the probability that the selected accident is unrelated to environment and will occur on the night shift.

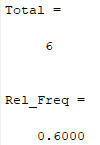
(d) If the selected accident was attributes to unsafe environments, then compute the probability that it will occur on the swing shift.

**Problem 5: Monte Carlo Simulation to learn the Law of Large Numbers based on tossing a coin experiment**

The following MATLAB code randomly generates values between 0 and 1, and computes the relative frequency (proportion of time) of observing head when tossing **fair coin** n times.



Below is the output from the above code:



Next, we compute the relative frequency of observing head in several number of trials (tossing a **weighed coin with 0.7 probability of observing head**) and plot using the following MATLAB code.



The following figure is the output plot from the above MATLAB code:



The above code is written for a weighted coin with a probability 0.7 of turning up head.

**Here is what you have to do:**

**Assume that a bias (or weighted) coin has a probability 0.25 of turning up head.**

Change the above 2nd MATLAB code appropriately (or write your own code) to create a plot showing the law of large numbers for this experiment with weighted coin. Change the numbers and titles appropriately.

(a) Copy and paste your plot here. (To copy a figure in MATLAB, click on **Edit** tab on the top of **Figure** Window and select **Copy Figure**.)

(b) What can you say based on your plot? what happens to the relative frequency of observing head when the number of trials increases?

(c) Copy and paste your complete MATLAB code (from MATLAB script) here. NO output here.