PSFML Sessions 4&5 Homework

Full Name: _____

Group No.: ____

Lecturer Name: _____

Submission date: _/_/__ **Grade: __/20**

Please write down all the steps not the final answer only

Questions (20 points):

1. (5 points) Suppose that the time between emergency calls to a fire station follows an exponential distribution with an average rate of 1.8 calls per day.
    a) A fireman has just arrived. What is the chance of a call in the next 15 minutes?
    b) A fireman has finished his shift 15 minutes to go with no call during his shift. What is the chance of a call will happen in the next 15 minutes?

2. (4 points) Suppose that crowd size at home games for a particular football club follows a Normal distribution with mean 26 000 and standard deviation 5000. What percentage of crowds are between 31 000 and 36 000? (Hint: F(1) = 1-Q(1)= 0.8413 and F(2) = 1- Q(2) = 0.9772). (Also, try using the 68-95-99.7% rule.)

3. (4 points) Suppose we send 30% of our products to company A and 70% of our products to company B. Company A reports that 5% of our products are defective and company B reports that 4% of our products are defective.
    a) Find the probability that a product is sent to company A and it is defective.
    b) Find the probability that a product is sent to company B and it is not defective.

4. (4 points) One box has 7 red balls and 3 white balls; a second box has 6 red balls and 4 white balls. A pair of dice are tossed. If the sum of the dice are less than

five, a ball is selected from the first box, otherwise the ball is selected from the second box. Find the probability of getting a red ball.

5. (3 points) A basketball team is to play two games in a tournament. The probability of winning the first game is 10%. If the first game is won, the probability of winning the second game is 15%. If the first game is lost, the probability of winning the second game is 25%. What is the probability the first game was won if the second game is lost?

Practice with code (Ungraded but MUST DO BEFORE THE PRACTICAL SESSION):

1. Open and run Distributions.ipynb
2. For each distribution compute the expected value, var, std and create another random variable from different distribution and compute the correlation and covariance.
3. Re-code all the coding using scipy.stats instead of numpy using [binom, poisson, norm, expon, uniform(), pmf(), cdf(), mean(), var(), std(), rvs()]

Readings:

- Discrete Probability Distributions (with solved examples): https://learn.lboro.ac.uk/archive/olmp/olmp_resources/pages/workbooks_1_50_jan2008/Workbook37/37_1_dscrt_prob_distn.pdf
- PMF and PDF: https://towardsdatascience.com/probability-concepts-explained-probability-distributions-introduction-part-3-4a5db81858dc
- Joint, marginal and conditional probability: https://towardsdatascience.com/deep-learning-book-series-3-4-and-3-5-marginal-and-conditional-probability-8c6239e453b8
- Bayes rule: https://www.mathsisfun.com/data/bayes-theorem.html
- Naïve Bayes Classifier with examples: https://web.iitd.ac.in/~bspanda/BY.pdf
- Naïve Bayes Classifier with python implementation: https://www.analyticsvidhya.com/blog/2021/01/a-guide-to-the-naive-bayes-algorithm/
- Maximum likelihood: https://www.mygreatlearning.com/blog/maximum-likelihood-estimation/

- List of all Probability distributions https://www.statisticshowto.com/probability-distribution/