Mathematics Assignment - 04
Random Variables and Probability Distributions

October 25, 2018

Question 01

A quality control engineer is in charge of testing whether or not 90% of the DVD players produced by his company conform to specifications. To do this, the engineer randomly selects a batch of 12 DVD players from each day's production. The day's production is acceptable provided no more than 1 DVD player fails to meet specifications. Otherwise, the entire day's production has to be tested.

1. What is the probability that the engineer incorrectly passes a day's production as acceptable if only 80% of the day's DVD players actually conform to specification?

2. What is the probability that the engineer unnecessarily requires the entire day's production to be tested if in fact 90of the DVD players conform to specifications?

Question 02

Suppose the number of hits a web site receives in any time interval is a Poisson random variable. A particular site gets on average 5 hits per second.

1. What is the probability that there will be no hits in an interval of two seconds?

2. What is the probability that there is at least one hit in an interval of one second?

Question 03

During a bad economy, a graduating ECE student goes to career fair booths in the technology sector (e.g., Google, Apple, Qualcomm, Texas Instruments, Motorola, etc) - and his/her likelihood of receiving an off-campus interview invitation after a career fair booth visit depends on how well he/she did in ECE 313. Specifically, an A in 313 results in a probability $p = 0.95$ of obtaining an invitation, whereas a C in 313 results in a probability of $p = 0.15$ of an invitation

1. Give the PMF for the random variable Y that denotes the number of career fair booth visits a student must make before his/her first invitation including the visit that results in the invitation. Express your answer in terms of p

2. On average, how many booth visits must an A student make before getting an off-campus interview invitation? How about a C student?

Question 04

The birth rate of a particular bacteria is noted to be 1.8 per microsecond. What is the probability of the following: -

1. Occurring 4 births in a microsecond ?
2. Occurring more than or equal to 2 births in a microsecond ?

Question 05

The number of miles that a particular car can run before its battery wears out is exponentially distributed with an average of 10,000 miles. The owner of the car needs to take a 5000-mile trip. What is the probability that he will be able to complete the trip without having to replace the car battery?

Question 06

On the average, a certain computer part lasts ten years. The length of time the computer part lasts is exponentially distributed.

1. What is the probability that a computer part lasts more than 7 years?
2. On the average, how long would five computer parts last if they are used one after another?
3. Eighty percent of computer parts last at most how long?
4. What is the probability that a computer part lasts between nine and 11 years?

Question 07

In a factory there are 45 accidents per year and the number of accidents per year follows a Poisson distribution. Use the normal approximation to find the probability that there are more than 50 accidents in a year.