MMA 863 – Team Assignment 2

Some random problems – problems tend to be more difficult when they are removed from context. This is one reason why exams are perceived as more difficult than problems in textbooks. These are deliberately mixed around (as are real-world problems!) Provide details in your answer (e.g. parameters, number lines, pictures, functions) as appropriate to support your work.

1. Which is more likely: rolling 6 standard dice and getting either a 5 or 6 on at least 3 of them; or rolling 5 standard dice and getting a 4, 5 or 6 on at least 4 of them?

**Answer: It is more likely to roll a dice 6 times and get a 5 or 6 at least 3 times.**

Note: assumption that “rolling X standard dice” mean rolling 1 standard die X times

Is Poisson or Binomial a better fit? Binomial is a better fit: specific number of outcomes, with identical and independent experiments. Only two outcomes, success or failure.

Binomial

1. Success = roll 5 or 6

Number of success = 3 or more

Probability of success = 2/6 = 1/3

Number of trials = 6

1 - cumulative 2 successes

1. Success = roll 4 or 5 or 6

Number of success = 4 or more

Probability of success = 3/6 = 1/2

Number of trials = 5

1. - cumulative 3 successes
2. =1-BINOM.DIST(2,6,1/3,TRUE)= 0.319615912 = 32.0%
3. =1-BINOM.DIST(3,5,1/2,TRUE)= 0.1875 = 18.75%

**Checking results using Poisson- didn’t work out so well (see below)**

Poisson

1. Pr of rolling 5 or 6 = 2/6= 1/3
2. Pr of rolling 4 or 5 or 6 = 3/6 = 1/2
3. Chance of having an event that is 1/3 likely happen at least 3/6=1/2 of the time or
4. Chance of having an event that is 1/2 likely happen at least 4/5 of the time
5. = 1- POISSON.DIST(1/2,1/3,TRUE) = 0.283468689 = 28.3%
6. =1-POISSON.DIST(4/5,1/2,TRUE)= 0.39346934= 39.3%

**Note: disturbing that B is so different between P&B, enough to change the answer to the question.**

1. During a thunderstorm, you see a lightning strike about once every 5 minutes. During a 20 min storm, what is the probability of their being between 5 and 7 strikes (inclusive)?

**Answer: During a 20 minute storm, there is 16.4% chance that there will be either 5, 6, or 7 lightning strikes.**

**The Poisson distribution deals with situations where things happen randomly at a given rate over time or space**

Poisson: (1) (lightning strike) every (5 min)

(4) (lightning strike) every (20 min)

probability 7 cuml – prob 5 cuml

**|--------------------5—THIS IS THE AREA----7--------------------|**

=POISSON.DIST(7,4,TRUE) - POISSON.DIST(5,4,TRUE)

= 0.948866384 - 0.785130387 = 0.163735997 = 16.4%

1. How many words would you have to pick, at random, from a dictionary, to know the proportion of words with the letter R in them within 1% with 95% confidence?

**Answer: We would need to pick 98 words to be 95% confident of being within 1% of the actual proportion of words that include at least one R.**

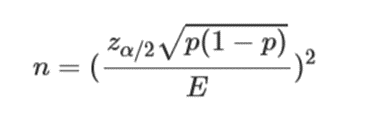
Solve for n

E = 1% = .01

CI = 95% = .95, alpha = 1 - .95 = .05

Z = =NORM.S.INV(1-0.05/2) = 1.959963985 = 1.96

We want a conservative estimate, so we use p =.5 (to maximize n)



n = [1.96√.5(1-.5)]/.01 = (1.96)(√.25)/.01 = (1.96)(.5)/.01 = 98

1. I need to have $100,000 in 5 years’ time. I am certain I can achieve 3% continuous growth if I invest in XYZ today. How much do I have to invest?

**Answer: $86,260.88**

Solve for PV

Rate = 3% = .03, N = 5, Beginning of period =1

=-PV(0.03,5,0,100000,1) = $86,260.88

1. Pretend I am your manager. I am thinking of replacing a machine with a new one because I suspect the defect rate with the machine is too high.
   * 1. Explain to me how I could set up a test to do this.

**Answer:**

Establish an acceptable average defect rate

Take sample of defect rate

Calculate the confidence interval and find if the machine is in or out of the CI

* + 1. Would it be OK to start with an assumption that I should change the machine and look for evidence that I should not? What would the implications be?

**Answer:**

If you start with the assumption that the defect rate is too high, then the experiment will need to disprove that assumption, or at least offer very compelling evidence.

It would be advisable to define what results would be deemed to have disproved the assumption. For example, if it is found that the actual defect range has a 95% of being within the accepted defect range, it will disprove the assumption.