Halleck Fall 2015 Final exam review solution 2572:

Sample problems:

2. A desk has three drawers. The first contains two gold coins, the second has two silver coins, and the third has one gold coin and one silver coin. A coin is drawn from a drawer selected at random. Suppose the coin selected was silver. What is the probability that the other coin in that drawer is gold?

**P(3|S)=P(3∩S)/P(S)=(1/6)/(1/3+1/6)=1/3 NOTE: to receive any credit for this problem, you must draw tree.**

3. Combinatorial Probability

1. Poker
2. Find the probability of a full house (3 of a kind and 2 of a kind.

**13(4 nCr 3)12(4 nCr 2)/(52 nCr 5)**

1. Find the chance of a straight with no face cards (J, Q, K).

**Straight can begin with A-6 so 6 4^5/(52 nCr 5)**

1. Given that a 7 character password (letters and digits only) must have 3 letters and 4 digits,
   * 1. What is the chance of A=first character is a letter?

**(6 nCr 2)26^3 10^4/((7 nCr 3)26^3 10^4)= (6 nCr 2) /(7 nCr 3)**

1. What is the chance of B=last character is a digit?

**(6 nCr 3)26^3 10^4/((7 nCr 3)26^3 10^4)= (6 nCr 3) /(7 nCr 3)**

1. What is the chance of A∩B=first character is a letter AND last character is a digit?

**(5 nCr 2)26^3 10^4/((7 nCr 3)26^3 10^4)= (5 nCr 2) /(7 nCr 3)**

1. Are the events A and B independent?

**(6 nCr 2) /(7 nCr 3)\* (6 nCr 3) /(7 nCr 3)=?(5 nCr 2) /(7 nCr 3)**

**This is equivalent to asking if (6 nCr 2)\*(6 nCr 3)= (7 nCr 3)\* (5 nCr 2)? NO: 300≠350 Basically, the chance that the last character is a digit increases if we know that the first character is a letter.**

4. Discrete

* 1. A bent coin is flipped 100 times. If the chance of a head is p= .4, find the chance that less than 35 of the flips will be heads. (binomial)
     1. use the binomial formula

**=binom.dist(34,100,.4,true)=13.0%**

ii. use the normal approximation (with continuity correction).

**np=100\*,4=40, √npq=√100\*.4\*.6=4.90**

**P(X<35)=P(X<34.5) (34.5-40)/4.90=1.12 P(Z<-1.12)=norm.s.dist(-1.12,true)=13.8%**

* 1. A corporate board contains twelve members four members of whom are accountants. The board creates a five-person Committee to Hide Corporation Debt. (hypergeometric)
     1. What is the probability that the Committee will contain two accountants and three non-accountants**? (4 nCr 2)(8 nCr 3)/(12 nCr 5)=42.4%**
     2. On average, how many accountants will be selected? **The chance an accountant is selected each time is 1/3. Since 5 members will be selected, the expectation is 5/3~1.7**
     3. ~~What is the standard deviation for the number of accountants selected?~~

Is the standard deviation √(5\*1/3\*2/3)? No, this only works if you have independence. **The standard deviation will be somewhat less than this.**

* 1. Bill’s arrival to class on time is a Poisson Process. In the course of a semester, he averages arriving to class on time 5 times. What is the chance that he arrives on time at least 10 times? What is the standard deviation? (Poisson)

**=1-POISSON.DIST(9,5,TRUE) =3.2% √√5**

5. Continuous:

1. Also find the mean and standard deviation (general):



**F(x)=-c/(2x^2)+K: evaluate between 1 and ∞ to get c/2. Hence c=2. Thus: F(x)=-1/x^2+K since F(1)=0, K=1.**

**F(x)=-1/x^2+1**

**P(1/2<x<2)= P(1<x<2)=F(2)-F(1)=F(2)=-1/4+1=3/4 P(-1/2<X<1/2)=0**

**Mean=Int(2/x^2,1,inf)=2**

**Var=Int(2/x,1,inf)-2^2=2ln(inf)-4=inf**

1. The most recent poll shows that while 35% of Republican voters support Trump in his bid for their candidacy, 65% of general voters are “concerned or frightened” by the prospect of his presidency. 1053 voters were polled. The NYT article:

<http://www.nytimes.com/politics/first-draft/2015/12/10/trump-solidifies-his-lead-but-leaves-many-nervous/>

claims a margin of error of ±4% for the anti-Trump numbers. Confirm or negate the NYT claim. (Be sure to draw a graph indicating the 95% confidence interval.) (normal)

**=.65 =√.65\*.35 stderr=/√1053=.015 Looks like the margin really is ±3%.**

1. ~~On a farm outside NYC, the chance of the last freeze occurring on a certain date drops off (approximately) exponentially starting April 1. The last freeze averages April 15. Find the chance that the last freeze will occur on or after May 1. (exponential)~~
2. ~~The time it takes for a recession to occur is exponentially distributed with mean 7 years. Find the chance that it will take more than 10 years for the next 2 recessions to occur (gamma).~~

6. Hypothesis testing (and confidence intervals)

a. Using the accompanying excel file for the weights of cocoa in an 8 oz can. Do we have enough evidence at the 5% level to reject the claimed average weight of cocoa? (t-distribution, 1-tail)

b. Use the accompanying excel file for the fly wing lengths. If the accepted value for the fly wing length is 45 x .1mm, do we have enough evidence at the 5% level to reject the accepted value. (t-dist, 2-tail)

c. Using the accompanying excel file for the fly wing lengths. Find the 95th confidence interval for the fly wing standard deviation. (chi-square)

d. using the chart below for worker absences, do we have enough evidence to reject the hypothesis that the distribution is uniform or have we shown that workers tend to extend their weekends and call in “sick”. (chi-square)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| M | T | W | Th | F |
| 28 | 15 | 17 | 18 | 22 |

e. using the accompanying file for level of smoking vs attentiveness to anti-smoking ads. Is the attentiveness to the ads independent of the level of smoking? (chi-square)