STAT 13 Homework 3 Solutions

http://www.stat.ucla.edu/~dinov/courses_students.dir/08/Fall/STAT13.1.dir/assignments.html

1. (a) The probability that both siblings are affected is zero because the female offspring has no chance of being affected.

(b) We need to consider the case of having either two males, two females, or one of each. P(one sibling is affected) = P(BB & 1 affected) + P(BG & 1 affected) + P(GB & 1 affected) + P(GG & 1 affected) = P(BB is born)*P(1 of BB is affected) + P(BG is born)*P(1 of BG is affected) + P(GB is born)*P(1 of GB is affected) + P(GG is born)*P(1 of GG is affected) = $(0.513)^2[2*(0.5)*(1-0.5)] + (0.513)(0.487)*(0.5) + (0.487)(0.513)*(0.5) + (0.487)^2*(0) = 0.381$

(c) P(neither sibling is affected) = P(BB)*P(0 of BB is affected) + P(BG)*P(0 of BG is affected) + P(GB)*P(0 of GB is affected) + P(GG)*P(0 of GG is affected) = $(0.513)^2*(1-0.5)^2 + (0.513)(0.487)*(1-0.5) + (0.487)(0.513)*(1-0.5) + (0.487)^2(1) = 0.553$

2. (a) P(+) = P(+ | present)*P(present) + P(+ | absent)*P(absent) = (0.92)*(0.10) + [1 – P(- | absent)]*[1 – P(present)] = 0.092 + (1-0.94)(1-0.10) = 0.146

(b) P(present | +) = $\frac{P(+\&present)}{P(+)} = \frac{P(present)*P(+\mid present)}{P(+)} = \frac{(0.10)(0.92)}{0.146} = 0.630$

3. (a) P(Y=3) = $\frac{610}{5000} = 0.122$

(b) P(Y >= 7) = P(Y=7) + P(Y=8) + P(Y=9) + P(Y=10) = $\frac{130}{5000} + \frac{26}{5000} + \frac{3}{5000} + \frac{1}{5000} = 0.032$

(c) P(4 <= Y <= 6) = P(Y=4) + P(Y=5) + P(Y=6) = $\frac{1400}{5000} + \frac{1760}{5000} + \frac{750}{5000} = 0.782$

(d) Mean of Y = $\frac{1(90) + 2(230) + ... + 10(1)}{5000} = 4.487$

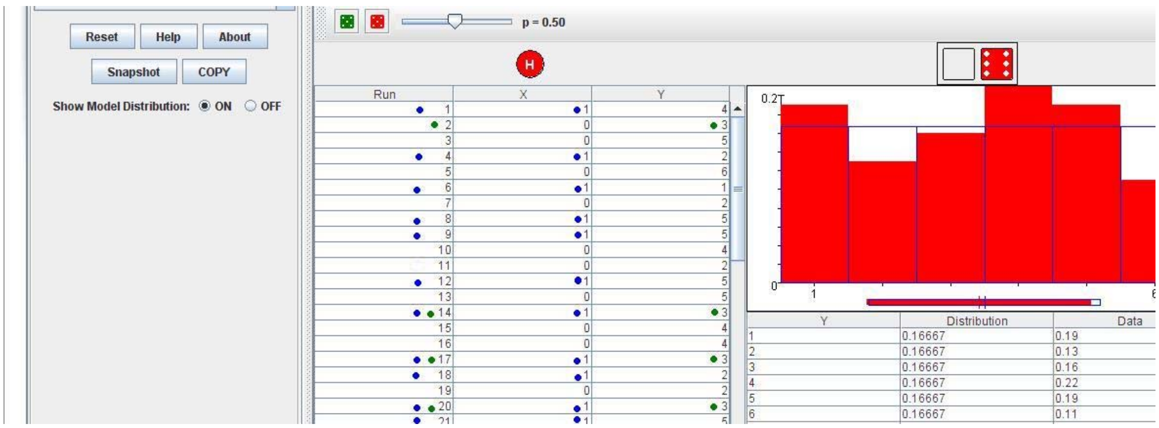
4. (a) P(Y >= 2) = P(Y=2) + P(Y=3) = 0.189 + 0.027 = 0.216

(b) P(Y <= 2) = P(Y=0) + P(Y=1) + P(Y=2) = 0.343 + 0.441 + 0.189 = 0.973

(c) Mean of Y = 0(0.343) + 1(0.441) + 2(0.189) + 3(0.027) = 0.9

5. (a) First, manually calculate P(heads & 3), P(heads), and P(3) by using data from the simulations. Second, compare P(heads & 3) with P(heads)*P(3). These quantities should be approximately the same, which proves that flipping heads is independent from rolling a 3 on the die.

(b) Do the same calculation for P(heads & 3), P(heads), and P(3). This time, the quantities should be significantly different, which shows that P(heads) and P(3) are dependent on each other.



Above is the data when you choose the option Update 1 (which is a must) and Run 100. I put a blue dot on each observation with heads (X=1) and I put a green dot on each observation with the number 3 in the Y column. So far, I have 11 observations with heads, 4 observations with the number 3, and 3 observations with both heads and number 3. Keep counting these observations until you obtain all 100 observations by scrolling down on the bar between the dotted data and the histogram.