Lab 3: Statistics 213 (L05) - Fall 2007

- To find both **point and cumulative probability** of a random variable that has Binomial, Hypergeometric or Poisson distribution

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1. Let $X \approx Binomial(10, 0.6)$
   - $P(X = 4) = 0.1115$
   - $P(X < 4) = P(X \leq 3) = 0.0548$
   - $P(2 \leq X \leq 4) = P(X \leq 4) - P(X \leq 1) = 0.1662 - 0.0017$
2. Let $X \approx Hyper(5, 10, 20)$
   - $P(X = 4) = 0.0295$
   - $P(X < 4) = P(X \leq 3) = 0.9688$
   - $P(2 \leq X \leq 4) = P(X \leq 4) - P(X \leq 1) = 0.9982 - 0.4488$
3. Let $X \approx Poisson(4)$
   - $P(X = 4) = 0.1954$
   - $P(X < 4) = P(X \leq 3) = 0.4335$
   - $P(2 \leq X \leq 4) = P(X \leq 4) - P(X \leq 1) = 0.6288 - 0.0916$
4. In a large population of flatworms in a certain pond, 3 in 10 is adult and 7 in 10 is juvenile.

   a. If 15 flatworms are selected, what is the probability that more than five will be adults ?

   b. Suppose that in another pond, a large population of flatworms exists such that only 1 in 100 is adult. If 400 flatworms are randomly selected from this population, what is the approximate probability that between four and eight, inclusive, are adult? Justify the use of the approximation you use.

5. A batch of 400 resistors is to be shipped if it is found that a random sample of 10 resistors has 2 or fewer defectives. Suppose that there are 40 defectives in the batch of 400.

   a. Find the probability that the lot will be shipped.

   b. What is the approximate probability that the lot will be shipped ? Justify the use of the approximation you use.

- Turn on the computer and activate the MINITAB program

  Start $\Rightarrow$ **Programs** $\Rightarrow$ **MINITAB 14** $\Rightarrow$ **MINITAB**

- a random variable X, $Binomial(10, 0.6)$

  Calc $\Longrightarrow$ **Probability Distribution** $\Longrightarrow$ **Binomial**

  – To calculate a point probability $P(X = 4)$

  i. click "probability"; Number of trials $\Longrightarrow$ type 10; Probability of success $\Longrightarrow$ type 0.6; Input constant $\Longrightarrow$ type 4

  – To calculate a cumulative probability $P(X \leq 4)$

  ii. click "cumulative probability"; Number of trials $\Longrightarrow$ type 10; Probability of success $\Longrightarrow$ type 0.6; Input constant $\Longrightarrow$ type 4

- a random variable X, $Hyper(5, 10, 20)$

  Calc $\Longrightarrow$ **Probability Distribution** $\Longrightarrow$ **Hypergeometric**

  – To calculate a point probability $P(X = 2)$

  i. click "probability"; Population size (N) $\Longrightarrow$ type 30; Success in population (M) $\Longrightarrow$ type 10; Sample size (n) $\Longrightarrow$ type 5; Input constant $\Longrightarrow$ type 2

  – To calculate a cumulative probability $P(X \leq 3)$

  ii. click "cumulative probability"; Population size (N) $\Longrightarrow$ type 30 ; Success in population (M) $\Longrightarrow$ type 10; Sample size (n) $\Longrightarrow$ type 5; Input constant $\Longrightarrow$ type 3

- a random variable X, $Poisson(4)$

  Calc $\Longrightarrow$ **Probability Distribution** $\Longrightarrow$ **Poisson**

  – To calculate a point probability $P(X = 3)$

  i. click "probability"; Mean $\Longrightarrow$ type 4; Input constant $\Longrightarrow$ type 3

  – To calculate a cumulative probability $P(X \leq 3)$

  ii. click "cumulative probability"; Mean $\Longrightarrow$ type 4; Input constant $\Longrightarrow$ type 3

- Exit MINITAB: MINITAB will ask you if you want to save things, select NO

Solutions

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4. Let X be the number of adults in 15 samples $\approx Binomial(15, 0.3)$ (a). $P(X > 5) = 1 - P(X \leq 5) = 1 - \sum_{x=0}^{5} \binom{15}{x} (0.3)^x (0.7)^{15-x} = 1 - 0.7216$ (b). $n = 400, p = 0.01, np = 4 < 7 \approx Poisson(4)$, $P(4 \leq X \leq 8) = \sum_{x=4}^{8} \frac{4^x e^{-4}}{x!} = P(X \leq 8) - P(X \leq 3) = 0.9786 - 0.4335$

5. Let X be the number of defectives $\approx Hyper(10, 40, 360)$, (a). $P(X \leq 2) = \sum_{x=0}^{2} \frac{\binom{40}{x}\binom{360}{10-x}}{\binom{400}{10}} = 0.9322$ (b). $\frac{n}{N} = 0.025 < 0.05, \frac{40}{400} = 0.1 = p$, $Hyper(10, 40, 360) \approx Binomial(10, 0.1)$ $P(X \leq 2) = \sum_{x=0}^{2} \binom{10}{x} (0.1)^x (0.9)^{10-x} = 0.9298$