Stat 414 Quiz #2

Spring 2016

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Start Time: 10:49 am/(pm) Stop time: 11:12 am/(pm)

You must show all of your work in order to receive full and/or partial credit. 10 points

1. 1 points A labor dispute has arisen concerning the distribution of 20 laborers to four different jobs for the same company. The distributions of the jobs are shown below.

   Job 1 required 6 laborers (very desirable)

   Job 2 required 4 laborers

   Job 3 required 5 laborers

   Job 4 required 5 laborers

   The dispute arose over an alleged random distribution of the laborers to the jobs which placed all four friends of the supervisor on Job 1.

   (a) 2 points Determine the number of ways the 20 laborers can be divided into groups appropriate to fill of the jobs.

   $$\binom{20}{6}\cdot\binom{14}{4}\cdot\binom{10}{5}\cdot\binom{5}{5}$$

   $$\frac{20!}{6!\,14!}\cdot\frac{14!}{4!\,10!}\cdot\frac{10!}{5!\,5!}\cdot\frac{5!}{5!\,0!}=\frac{20!}{6!\,4!\,5!\,5!}\approx 9777287520$$

   (b) 2 points Determine the probability of the event if it is assumed that they were randomly assigned to the jobs.

   $$\binom{16}{2}\binom{14}{4}\binom{10}{5}\binom{5}{5}$$

   $$\frac{16!}{2!\,14!}\,\frac{14!}{4!\,10!}\,\frac{10!}{5!\,5!}\,\frac{5!}{5!\,0!}=\frac{16!}{2!\,4!\,5!\,5!}=30270240$$

   $$P(\text{4 friends in Job 1})=\frac{\frac{16!}{2!\,4!\,5!\,5!}}{\frac{20!}{6!\,4!\,5!\,5!}}=\frac{16!\,6!\,4!\,5!\,5!}{20!\,2!\,4!\,5!\,5!}$$

   $$\frac{16!}{20!}=\frac{1}{20\cdot 19\cdot 18\cdot 17}\qquad 6!=6\cdot 5\cdot 4\cdot 3$$

   $$=\frac{360}{116280}=\underline{0.0031}$$

2. 3 points A student has to answer 7 out of 10 questions on an exam.

(a) 1 point How many choices has she to pick 7 out of the 10 questions?

$$\binom{10}{7} = \frac{10!}{7!\,3!} = \frac{10\cdot 9\cdot 8}{3\cdot 2\cdot 1} = \frac{720}{6} = 120$$

(b) 2 points How many if she must answer at least 3 of the first five questions?

$$\binom{5}{3}\binom{5}{4} + \binom{5}{4}\binom{5}{3} + \binom{5}{5}\binom{5}{2}$$

$$= 10\cdot 5 + 5\cdot 10 + 1\cdot 10$$

$$= 50 + 50 + 10 = 110$$

3. 3 points An insurance company believes that people can be classified into two classes: those that are accident prone and those that are not. The company's statistics show that an accident prone person will have an accident at some time within a certain time period with probability of 0.4. The probability for a non-accident prone person is 0.2. Assume that thirty percent of the population is accident prone. What is the probability that a new policy holder will have an accident with this certain time frame of purchasing the policy?

$P(\text{ACCIDENT} \mid \text{PRONE}) = .4$

$P(\text{ACCIDENT} \mid \text{NOT PRONE}) = .2$

$P(\text{PRONE}) = .3 \Rightarrow P(\text{NOT PRONE}) = .7$

$$P(\text{ACCIDENT}) = P(\text{ACCIDENT} \mid \text{PRONE})P(\text{PRONE}) + P(\text{ACCIDENT} \mid \text{NOT PRONE})P(\text{NOT PRONE})$$

$$= .4(.3) + .2(.7)$$

$$= .12 + .14 = \boxed{.26}$$