Probability & Statistics

Preclass Problems 2/2/10
Sec 2.2 #2,8
Sec 2.3 #2,8,12

~~22)~~ 2.2) 2) $E[X(11-X)] = \sum_{x=1}^{10} \underbrace{x(11-x)}_{\text{event}} \underbrace{1/10}_{P(\text{event})} = 22$

2.2 8) $Y = \frac{X-\mu}{\sigma}$

$E(Y) = E\left(\frac{X-\mu}{\sigma}\right)$
$= \frac{1}{\sigma}(E(X)-\mu)$ note: σ and μ are constants
$= \frac{1}{\sigma}(\mu-\mu)$
$= \emptyset$

$Var(Y) = E(Y^2) - E(Y)^2$
$= E\left(\frac{(X-\mu)^2}{\sigma^2}\right) - 0^2$
$= \frac{1}{\sigma^2}E((X-\mu)^2)$
$= \frac{1}{\sigma^2}\sigma^2$
$= 1$

2.3 2)
- Binormal Distribution: $p=0.7$, $n=25$
- Let X be the number of people who think the IRS lacks power
- Let $(25-X)$ be the number of people who think opposite w/ $b(25, 0.3)$

Note: do this because $b(25, 0.3)$ is in table II but $b(25, .7)$ isn't

a) $P(X \geq 13) = P((25-X) \leq (25-13))$
$= P((25-X) \leq 12)$
$= 0.9825$

b) $P(X \leq 11) = P((25-X) \geq (25-11))$
$= P((25-X) \geq 14)$
$= 1 - P((25-X) \leq 13)$
$= 1 - .9940$
$= 0.0060$

c) $P(X=12) = P((25-X) = 13)$
$= P((25-X) \leq 13) - P((25-X) \leq 12)$
$= 0.9940 - .9825 = 0.0115$

d) $\mu = 25 \cdot .7 = 17.5 = n \cdot p$
$\sigma^2 = n \cdot p \cdot (1-p) = 25 \cdot .7 \cdot .3 = 5.25$
$\sigma = \sqrt{\sigma^2}$

2.3 8) - 5 possible answers, 1 is correct & student is randomly guessing

- $P(\text{correct}) = \frac{1}{5} = 0.2$

a) $P(4^{th}\text{ correct}) = P(\text{incorrect})P(\text{incorrect})P(\text{incorrect})P(\text{correct})$

$= 0.8^3 \cdot 0.2^1 = 0.1024$

b) X is the first time the student is correct

$f(x) = \underset{\substack{\uparrow \\ \text{get all} \\ \text{prior wrong}}}{.8^{x-1}} \cdot \underset{\substack{\uparrow \\ \text{get last} \\ \text{correct}}}{.2}$

Note: this question follows a negative binormal distribution / geometric

$\mu = \frac{1}{p} = 5$

$\sigma^2 = \frac{1-p}{p^2} = 20$

2.3 12) $\lambda = {}^{225ft}/_{150ft.}$

$\lambda = 1.5$ note: for every 150ft there was an average (λ_0) of 1 error. Now for 225 ft there is an average $\lambda = 1.5$ errors

$P(X \leq 1) = \sum_{n=0}^{1} \frac{\lambda^x e^{-\lambda}}{x!}$

$= \frac{1.5^0 e^{-1.5}}{0!} + \frac{1.5^1 e^{-1.5}}{1!}$

$= 0.5578$