Statistics 300 **Summer 2007**
Quiz #7 **5:30-7:50 p.m.** **Name:** Solution

(3 points, 2 minutes)

1. **What are the appropriate expressions (formulas) for the mean, variance, and standard deviation in the context of a discrete probability distribution?**

Parameter	Expression
μ	$\sum x \cdot P(x)$
σ^2	$\sum (x-\mu)^2 \cdot P(x)$
σ	$\sqrt{\sum (x-\mu)^2 \cdot P(x)}$

(7 points : 7 minutes)

2. **For each of the problems below (here and on next page), determine whether a valid probability distribution is described and, if so, calculate the mean, variance, and standard deviation.**

(a) **A manufacturer makes a product that can have defects in 5 different ways, so some of the product will have 0 defects, some 1, 2, 3, 4, or 5 defects. The manufacturer claims that 82.8% have 0 defects, 12.8% have 1, 1.3% have 2, 0.9% have 3, 0.2% have 4, and 0.1% have 5 defects.**

μ = __________

σ^2 = __________

σ = __________

x	P(x)				
0	0.828				
1	0.128				
2	0.013				
3	0.009				
4	0.002				
5	0.001				

Not a valid distribution

$\sum P(x) = 0.981$

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2. (Continued)

(b) Use the relative frequency in the recent past as a probability distribution for the near future. Judges in an ice skating contest award scores from 1 through 6 for 288 contestants. Ten judges awarded a total of 2880 scores in the proportions listed as probabilities in the distribution below. What are the mean, variance and standard deviation of this distribution?

$\mu =$ 3.48

$\sigma^2 =$ 2.189

$\sigma =$ 1.48

x	P(x)	$x \cdot P(x)$	$(x-\mu)^2 \cdot P(x)$		
1	0.11	0.11	0.677		
2	0.17	0.34	0.372		
3	0.21	0.63	0.048		
4	0.26	1.04	0.070		
5	0.14	0.70	0.323		
6	0.11	0.66	0.699		
		$\Sigma x \cdot p(x)$	$\Sigma (x-\mu)^2 \cdot p(x)$		

$= \mu = 3.48$ $\quad = 2.189 = \sigma^2$

$\sigma = \sqrt{\sigma^2} = 1.48$

(5 points : 4 minutes)

3. Larry is sitting in an airport waiting for his son's flight, which will arrive in 8 hours. Larry is bored. He will get 12 M&Ms from a candy machine. The proportion of "RED" M&Ms among all the M&Ms made is 31%. If Larry's 12 M&Ms are a random selection from the population of all M&Ms, what is the probability that his 12 M&Ms will include exactly 5 RED candies?

$p = P(\text{red}) = 0.31$ $\quad P(\text{Not Red}) = q = 0.69$ $\quad n = 12$ $\quad x = 5$

random and small sample from large population implies "independence" and p stays the same from one M&M to the next. Binomial $X \sim B(6, 0.31)$

$$P(x=5) = {}_{12}C_5 (0.31)^5 (0.69)^7 = 0.169$$

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(9 points : 7 minutes)

4. (a) The percentage of "RED" M&Ms among all the M&Ms that are made is 31%. What are the mean and standard deviation for the number of RED M&Ms in randomly selected samples of 1800 M&Ms?

Binomial: $n = 1800$, $p = 0.31$

$\mu = np = 558$

$\sigma = \sqrt{npq} = 19.6$

(b) In a random sample of 1800 M&Ms, would it be unusual to find more than 580 RED M&Ms?

$x = 580$

$\left.\begin{array}{l}\mu = 558 \\ \sigma = 19.6\end{array}\right\}$ from part (a)

$$z = \frac{x - \mu}{\sigma} = \frac{580 - 558}{19.6} = \underline{\underline{1.12}}$$

Not unusual