Stats Review
Chapter 6

Mary Stangler Center for Academic Success

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Note:

This review is composed of questions similar to those found in the chapter review and/or chapter test. This review is meant to highlight basic concepts from the course. It does not cover all concepts presented by your instructor. Refer back to your notes, unit objectives, handouts, etc. to further prepare for your exam.

The questions are displayed on one slide followed by the answers are displayed in red on the next.

This review is available in alternate formats upon request.

Mean and Standard Deviation of Discrete Probability Model

In a sandwich shop, the following probability distribution was obtained. The random variable x represents the number of condiments used for a hamburger. Find the mean and standard deviation for the random variable x.

x	P(x)
0	.3
1	.4
2	.2
3	.06
4	.04

Mean and Standard Deviation of Discrete Probability Model

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		Step 1 (mean)	Step 2 (stand. dev.)
x	P(x)	xP(x)	$x^2P(x)$
0	.3	0*.3=0	0^2*.3=0
1	.4	.4	.4
2	.2	.4	.8
3	.06	.18	.54
4	.04	.16	.64

Expected Value = Mean

1) Multiply x by P(x)
2) Add the numbers from step 1

0+.4+.4+.18+.16=**1.14**. This is the mean.

Standard Deviation

1) Find the mean and square it,

$=1.14\ ^2=1.2996$

2) Take x^2 and multiply by P(x)
3) Add the values from step 2

0+.4+.8+.54+.64= 2.38

4) Take the number from step 3 and subtract from value from step 1: 2.38-1.2996=1.0804
5) Take the square root of the number from step 4, **1.04**. This is the standard deviation.

Discrete Probability Model

An insurance company sells a $25,000 one-year term life insurance policy for $500 to a 45-year-old woman. The probability that a 45-year-old woman survives the year is .98795. Compute and interpret the expected value of this policy to thee insurance company?

Discrete Probability Model

An insurance company sells a $25,000 one-year term life insurance policy for $500 to a 45-year-old woman. The probability that a 45-year-old woman survives the year is .98795. Compute and interpret the expected value of this policy to thee insurance company?

Probability that the woman dies=1-.98795=.01205

Expected value=-25000(.01205)+500(.98795)=**192.73**

(the 25000 is negative because that is how much the insurance company would lose)

The insurance company would expect to make $192.73.

Decide whether the experiment is a binomial experiment. If it is not, explain why.

1) You draw a marble 350 times from a bag with three colors of marbles. The random variable represents the color of marble that is drawn.

2) Selecting five cards, one at a time without replacement, from a standard deck of cards. The random variable is the number of picture cards obtained.

3) Survey 50 college students to see whether they are enrolled as a new student. The random variable represents the number of students enrolled as new students.

Decide whether the experiment is a binomial experiment. If it is not, explain why.

1) You draw a marble 350 times from a bag with three colors of marbles. The random variable represents the color of marble that is drawn.

No, more than two outcomes

2) Selecting five cards, one at a time without replacement, from a standard deck of cards. The random variable is the number of picture cards obtained.

No, trials are not independent because the cards are drawn without replacement.

3) Survey 50 college students to see whether they are enrolled as a new student. The random variable represents the number of students enrolled as new students.

Yes

Binomial Probability

Assume that male and female births are equally likely and that the births are independent.

Find the probability that there are exactly 9 girls out of 10 births

Find the probability that there is at least 1 girl out of 10 births

Find the probability that there are between 4 and 6 (inclusive) girls out of 10 births.

Binomial Probability

Assume that male and female births are equally likely and that the births are independent.

Find the probability that there are exactly 9 girls out of 10 births

$$P(X=9) = {}_{10}C_9\,(.5)^9(1-.5)^{10-9} = \mathbf{.0098}$$

Find the probability that there is at least 1 girl out of 10 births

$$P(x \geq 1) = 1 - P(0) = \mathbf{.999}$$

Find the probability that there are between 4 and 6 (inclusive) girls out of 10 births.

$$P(X=4) = {}_{10}C_4\,(.5)^4(1-.5)^{10-4} = .2051$$
$$P(X=5) = {}_{10}C_5\,(.5)^5(1-.5)^{10-5} = .2461$$
$$P(X=6) = {}_{10}C_6\,(.5)^6(1-.5)^{10-6} = .2051$$
$$P(4 \leq x \leq 6) = P(x=4) + P(x=5) + P(x=6)$$
$$= .2051 + .2461 + .2051 = \mathbf{.6563}$$

Binomial Mean and Standard Deviation

In 2000, it was reported that 11% of adult Americans had trust in the federal government's handling of domestic issues. Suppose a random sample of 1100 finds that 84 have a trust in the government's handling of domestic issues. Would these results be considered unusual?

Binomial Mean and Standard Deviation

In 2000, it was reported that 11% of adult Americans had trust in the federal government's handling of domestic issues. Suppose a random sample of 1100 finds that 84 have a trust in the government's handling of domestic issues. Would these results be considered unusual?

1) Find the Mean: (np) =1100*.11=121
2) Find the standard deviation: $\sqrt{np(1-p)} = \sqrt{1100(.11)(1-.11)}$ =10.38
3) For an event to be unusual, it must be outside the mean by two standard deviations (both ways)

   121-2(10.38)=100.24; 121+2(10.38)=141.76

Since 84 is outside this interval, the event is unusual.

Poisson Distribution

A stats professor finds that when he schedules an office hour at the 10:30 a.m. time slot, an average of three students arrive. Use the Poisson distribution to find the probability that in a randomly selected office hour in the 10:30 a.m. time slot exactly seven students will arrive.

Suppose that the number of babies born a month at a hospital follows a Poisson distribution with a mean of 6.3.

a) Find the probability that the *next two* months will both result in 5 births each occurring at this hospital.

b) Find the probability that at least 2 births occur at this hospital during a particular *one* month period.

Poisson Distribution

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x=7, λ=3, t=1

$P(x = 7) = \frac{(3\cdot 1)^7}{7!} e^{-3\cdot 1}$ =**.0216**

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a) Use $P(x) = \frac{\mu^x}{x!} e^{-\mu}$

$P(5) = \frac{6.3^5}{5!} e^{-6.3} = .151868$

This is the probability for one month. For two months

$= .151868 \cdot .151868 = \mathbf{.023064}$

b) $P(x \geq 2) = 1 - P(x \leq 1) = 1 - P(x = 0) - P(x = 1)$

$1 - \frac{6.3^0}{0!} e^{-6.3} - \frac{6.3^1}{1!} e^{-6.3} = \mathbf{.9866}$

Poisson Distribution
Mean and Standard Deviation

The number of goals scored at college soccer games follows a Poisson process with a goal scored every 21 minutes (a soccer game is 90 minutes long). What is the mean and the standard deviation of the number of goals scored during a game?

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Mean $\boldsymbol{\mu_x} = \lambda t = \frac{1}{21} \cdot 90 = \mathbf{4.29}$

λ=is the average number of occurrences of the event in some interval length $\lambda = \frac{1\ goal}{21\ minutes}$

Standard deviation $\boldsymbol{\sigma_x} = \sqrt{\lambda t} = \sqrt{\mu_x} = \sqrt{4.29} = \mathbf{2.07}$