BUS 240
Formulas

Symbols of parameters and statistics

μ = population mean	σ = population standard deviation
N = size of population	σ^2 = population variance
$\bar{X}$ = sample mean	**s** = sample standard deviation
n = size of sample	s^2 = sample variance

General

$n! = 1 \times 2 \times 3 \times \ldots \times n$

$\sum x_i = x_1 + x_2 + x_3 + \ldots + x_i$

Chapter 3

Means:

$\bar{X} = \frac{\sum x}{n}$ for raw sample data

$\mu = \frac{\sum x}{N}$ for a population

$\bar{X} = \frac{\sum fx}{\sum f}$ for sample data sorted into a frequency table

$X = \frac{\sum wx}{\sum w}$ for weighted sample data

Measures of Dispersion:

$\sigma = \sqrt{\sum (x - \mu)^2 / N}$ for a population

$s = \sqrt{\sum (x - \bar{x})^2 / (n-1)}$ for sample data

$s = \frac{\sqrt{n\sum x^2 - (\sum x)^2}}{\sqrt{n(n-1)}}$ shortcut formula for raw data

$s = \frac{\sqrt{n\sum fx^2 - (\sum fx)^2}}{\sqrt{n(n-1)}}$ shortcut formula for data sorted into a frequency table, and $n = \sum f$

$MD = \sum |x - \bar{X}| / n$ for the mean deviation of a sample

Chapter 5

$0 \leq P(x) \leq 1$ for any particular value of x

$\Sigma P(x) = 1.0$ for all possible values of x

$P(A) = 1 - P(\sim A)$ and $P(\sim A) = 1 - P(A)$ and $P(A) + P(\sim A) = 1$

Compound (joint) Probabilities

P(A or B) = P(A) + P(B) if A, B are ***mutually exclusive***

P(A or B) = P(A) + P(B) – P(A and B) if A, B are ***not mutually exclusive***

P(A and B) = P(A) · P(B) if A and B are ***independent***

P(A and B) = P(A) · P(B|A) if A and B are ***dependent***

Counting Rules

m · n = total number of ways two events can occur ***together*** if the first event can occur m ways and the second n ways.

n! = the number of ways n different items can be ***arranged*** (orders, sequences)

$_nP_r = \frac{n!}{(n-r)!}$ the number of ***permutations*** (arrangements, orders, sequences) when r items are selected from n available items (order of selection important)

$_nC_r = \frac{n!}{(n-r)!\,r!}$ the number of ***combinations*** when r items are selected from n available items (order of selection not important)

Chapter 6

$\mu = \Sigma x \cdot P(x)$ mean for any **discrete** probability distribution

$\sigma = \sqrt{\Sigma[(x - \mu)^2 P(x)]}$ standard deviation for any **discrete** probability distribution

$\sigma = \sqrt{[\Sigma x^2 \cdot P(x)] - \mu^2}$ shortcut formula for standard deviation of a **discrete** probability distribution.

$\mu = n \cdot \pi$ — mean for the special case of a **binomial** probability distribution, where n = sample size and π = probability of success on any one trial.

$\sigma = \sqrt{n \cdot \pi \cdot (1 - \pi)}$ — standard deviation for the special case of a **binomial** probability distribution where n= sample size, π = probability of success on any one trial, and $1-\pi$ = probability of failure on any one trial

$$P(x) = \left[\frac{n!}{(n-x)!\,x!}\right] \pi^{x} \cdot (1 - \pi)^{n-x}$$

binomial probability for any specific "x", where n = sample size, π = probability of success on any one trial, and $1-\pi$ = probability of failure on any one trial.

Chapter 7

For **continuous normal distributions**, the number of standard deviations "z" that a number "x" is from the mean "μ" is given by the formula

$$z = \frac{(x - \mu)}{\sigma}$$

where σ is the standard deviation of the normal distribution.

If a normal distribution has the characteristics that $\mu = 0$ and $\sigma = 1$, then the distribution is **standard normal** and x = z

Chapter 8

Central Limit Theorem – distributions of the means of samples

$$z = \frac{\overline{X} - \mu}{(\sigma/\sqrt{n})}$$

number of standard deviations of mean $\overline{X}$ of a sample of size "n" from the population mean.

Chapter 9

Margin of Error (E):

$E = (z_{\alpha/2} \cdot \sigma)/\sqrt{n}$ — if σ is known OR if $n \geq 30$. For unknown σ, use s.

$E = (t_{\alpha/2} \cdot s)/\sqrt{n}$ — if σ is unknown AND $n < 30$ and the distribution is normal

$E = z_{\alpha/2} \sqrt{\frac{p \cdot (1-p)}{n}}$ — if the distribution is a binomial and p = x/n is an estimate of the true population percentage π

Confidence Interval:

$\overline{X} - E \leq \mu \leq \overline{X} + E$ for a distribution of sample means

$p - E \leq \pi \leq p + E$ for a binomial distribution

Sample Size Required for a Pre-determined Margin of Error:

$$n = \left(\frac{z_{\alpha/2} \cdot \sigma}{E}\right)^2$$ for a distribution of sample means

$$n = \frac{p(1-p)(z_{\alpha/2})^2}{E^2}$$ for a binomial distribution

<u>Chapter 10</u>

Hypothesis Testing:

Null hypothesis $H_o : \mu \leq,\ =,$ or $\geq$ claimed value

Alternate hypothesis $H_1 : \mu <,\ \neq,$ or $>$ claimed value

Critical value: z-score or t-value related to the significance level α

Test statistic based on sample of size n:

If $n \geq 30$ or σ is known (for unknown σ use s) : $$z = \frac{\overline{X} - \mu}{(\sigma/\sqrt{n})}$$

If $n < 30$ AND σ is unknown: $$t = \frac{\overline{X} - \mu}{(s/\sqrt{n})}$$

If the distribution is binomial with $np \geq 5$ and $nq \geq 5$: $$z = \frac{p - \pi}{\sqrt{[\pi(1-\pi)]/n}}$$

P-value:

P-value = P(z > test statistic) for positive test statistics

P-value = P(z < test statistic) for negative test statistics