UNIT 1 FORMULA SHEET

for Sullivan, Statistics: Informed Decisions Using Data@2017 Pearson Education, Inc.

Chapter 2 Organizing and Summarizing Data

Relative Frequency = $\frac{frequency}{sum\ of\ all\ frequencies}$

Class midpoint: The sum of consecutive lower class limits, divided by 2.

Chapter 3 Numerically Summarizing Data

Listed Data

Mean

Population: $\mu = \frac{\sum x_i}{N}$

Sample: $\bar{x} = \frac{\sum x_i}{n}$

Standard Deviation

Population: $\sigma = \sqrt{\frac{\sum(x_i-\mu)^2}{N}}$

Sample: $s = \sqrt{\frac{\sum(x_i-\bar{x})^2}{n-1}}$

Grouped Data (frequency distribution)

Mean

Population: $\mu = \frac{\Sigma x_i f_i}{\Sigma f_i}$

Sample: $\bar{x} = \frac{\Sigma x_i f_i}{\Sigma f_i}$

Weighted: $\bar{x}_w = \frac{\sum w_i x_i}{\sum w_i}$

Standard Deviation

Population: $\sigma = \sqrt{\frac{\sum(x_i-\mu)^2 f_i}{\Sigma f_i}}$

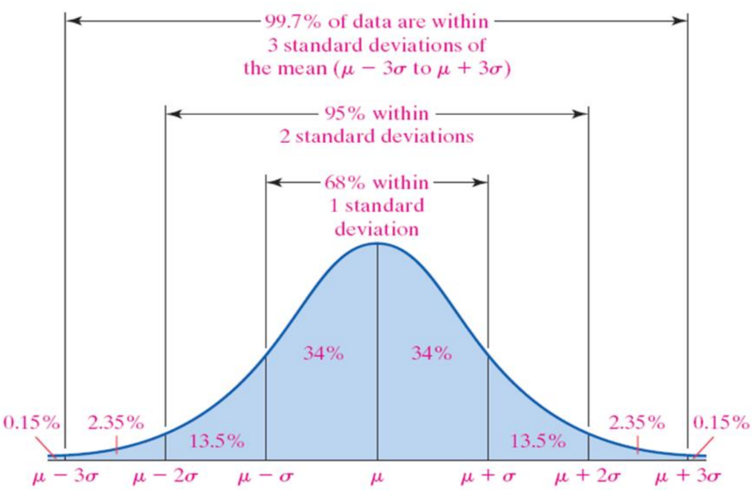
Sample: $s = \sqrt{\frac{\sum(x_i-\bar{x})^2 f_i}{(\Sigma f_i)-1}}$

Variance = standard deviation squared σ^2 or s^2

Range = Largest Data Value – Smallest Data Value

Class width=$\frac{range}{number\ of\ classes}$ (round up)

Empirical Rule: If the shape of the distribution is bell-shaped, then:



z-score (standardized test statistic):

Population: $Z = \frac{x-\mu}{\sigma}$

Sample: $Z = \frac{x-\bar{x}}{s}$

Interquartile Range: IQR = Q_3-Q_1

Lower and Upper Fences:

Lower: Q_1 - 1.5(IQR)

Upper: Q_3 + 1.5(IQR)

Five-Number Summary:

Minimum, Q_1, M, Q_3, Maximum

Chapter 4 Describing the Relation between Two Variables

Residual = observed y – predicted y: $y - \hat{y}$

Correlation Coefficient: $r = \frac{\sum\left(\frac{x_i-\bar{x}}{s_x}\right)\left(\frac{y_i-\bar{y}}{s_y}\right)}{n-1}$

The equation of the least-squares regression line is $\hat{y} = b_1 x + b_0$, where $\hat{y}$ is the predicted value,

$b_1 = r \cdot \frac{s_y}{s_x}$, is the slope, and $b_0 = \bar{y} - b_1\bar{x}$ is the intercept.

UNIT 2 FORMULA SHEET

for Sullivan, Statistics: Informed Decisions Using Data@2017 Pearson Education, Inc.

Chapter 5 Probability

Empirical Probability:

$$P(E) = \frac{frequency\ of\ E}{number\ of\ trials\ of\ the\ experiment}$$

Classical Probability:

$$P(E) = \frac{N(E)}{N(S)}$$

$$= \frac{number\ of\ ways\ that\ E\ can\ occur}{number\ of\ possible\ outcomes}$$

Compliment Rule: $P(E^c) = 1 - P(E)$

Multiplication Rule of Counting: the number of ways for a series of events (E_1, E_2, E_3…) to occur in order = $(n(E_1))(n(E_2))(n(E_3))$…

Factorial: $n! = n(n-1)(n-2)\ldots(3)(2)(1)$

Permutation of n objects taken r at a time:

$$nPr = \frac{n!}{(n-r)!}$$

Combination of n objects taken r at a time:

$$nCr = \frac{n!}{r!\,(n-r)!}$$

Permutations with Repetition:

$$\frac{n!}{n_1!\,n_2!\ldots n_k!}$$

Addition Rule for Disjoint Events:

P(E or F) = P(E) + P(F)

Addition Rule for n Disjoint Events:

P(E or F or G or…) = P(E)+P(F)+P(G)+...

General Addition Rule:

P(E or F) = P(E)+ P(F) - P(E and F)

Multiplication Rule for Independent Events:

P(E and F) = P(E) ● P(F)

Multiplication Rule for *n* Independent Events:

P(E and F and G…) =

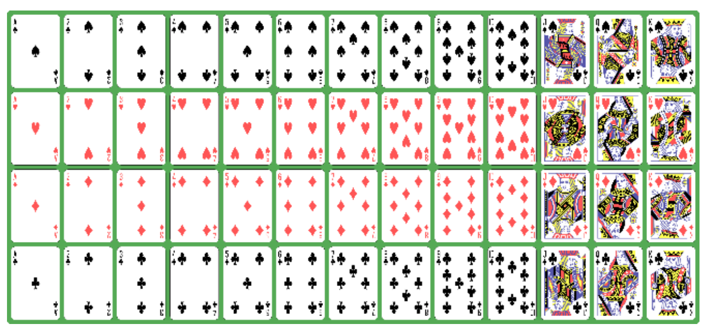
P(E)●P(F)●P(G)●...

General Multiplication Rule:

P(E and F) = P(E) ● P(F/E)

Conditional Probability Rule:

$$P(F\ /\ E) = \frac{P(E\ and\ F)}{P(E)} = \frac{N(E\ and\ F)}{n(E)}$$



Chapter 6 Discrete Probability Distributions

Mean (Expected Value) of a Discrete Random Variable:

$$\mu_x = \Sigma[xP(x)]$$

Standard Deviation of a Discrete Random Variable:

$$\sigma_x = \sqrt{\Sigma[(x-\mu)^2 P(x)]}$$

Chapter 7 The Normal Distribution

Standardizing a Normal Random Variable:

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

Finding the score (cut off for a given percent):

$$x = \mu + z\sigma$$

UNIT 3 FORMULA SHEET

for Sullivan, Statistics: Informed Decisions Using Data@2017 Pearson Education, Inc.

Chapter 8 Sampling Distributions

Sampling distribution of $\hat{p}$

Sample proportion $\hat{p} = \frac{x}{n}$

$\mu_{\hat{p}} = p$

$$\sigma_{\hat{p}} = \sqrt{\frac{p(1-p)}{n}}$$

$$z = \frac{\hat{p} - p}{\sqrt{\frac{p(1-p)}{n}}}$$

$n \leq 0.05N$ and $np(1-p) \geq 10$

Sampling distribution of $\bar{x}$

$\mu_{\bar{x}} = \mu$

$$\sigma_{\bar{x}} = \frac{\sigma}{\sqrt{n}}$$

$$z = \frac{\bar{x} - \mu}{\frac{\sigma}{\sqrt{n}}}$$

Underlying distribution is normal OR n $\geq$ 30

$\bar{x} = \mu_{\bar{x}} + z\,\sigma_{\bar{x}}$

Chapter 9 Estimating the Value of a Parameter

Confidence Intervals
Proportion
(1-α)*100% confidence interval about p is:

$$\hat{p} \pm E$$

$$E = z_{\propto/2}\sqrt{\frac{\hat{p}(1-\hat{p})}{n}}$$

Sample size to estimate the population proportion with a margin of error E

- $\hat{p}$ is a prior estimate of the population proportion:

  $n = \hat{p}(1-\hat{p})\left(\frac{z_{\propto/2}}{E}\right)^2$ rounded up to the next integer
- No prior estimate is available:

  $n = 0.25\left(\frac{z_{\propto/2}}{E}\right)^2$ rounded up to the next integer

Confidence Intervals
Mean
(1-α)*100% confidence interval about μ is:

$$\bar{x} \pm E$$

$$E = t_{\propto/2}\frac{s}{\sqrt{n}}$$

Sample size to estimate the population mean with a margin of error E

- $n = \left(\frac{z_{\propto/2} * s}{E}\right)^2$ rounded up to the next integer

Chapter 10 Hypothesis Tests Regarding a Parameter

Proportion

$$z = \frac{\hat{p} - p_0}{\sqrt{\frac{p_0(1-p_0)}{n}}}$$

Mean

$$t = \frac{\bar{x} - \mu_0}{\frac{s}{\sqrt{n}}}$$