Course Review Information
Statistics 301

Final is comprehensive, covers chapters 1–14 in both workbook and text.

- Data types and collection, roughly 5% of course, chapter 1.
- Descriptive statistics, roughly 25% of course, chapters 2, 3 and 4 (skip 4.5).
- Probability, roughly 30% of course, chapters 5 (skip 5.6, 5.7), 6 (skip 6.4), 7, 8.
- Statistical inference, roughly 40% of course, chapters 9–14.
  - Tests and CIs of μ, p, σ for one sample, chapters 9, 10 (skip 10.7).
  - Tests and CIs of μ, p, σ for two samples, chapter 11.
  - Tests of multiple p (categorical data), chapter 12.
  - Tests of multiple μ (ANOVA), chapter 13 (skip 13.2, 13.3, 13.4).
  - Linear regression (skip 14.3)
    Tests and CIs of slope β_1 (14.1)
    CIs (PIs) of mean (individual) prediction $\hat{y}$ (14.2).

Data types and collection

- data types
  population, parameter, sample, statistic (1.1 and rest of course)
  variable, data (1.1)
  nominal, ordinal (ranked), interval, ratio (1.1)
  qualitative (categorical), quantitative (discrete, continuous) (1.1)

- observed study and designed experiments
  observational study versus designed experiment (1.2)
  explanatory, response, confounding and lurking variables (1.2)
  observational: cross-sectional, retrospective, prospective (cohort) (1.2)
  experiment: completely randomized, randomized block designs (1.6)

- sampling
  simple random sample (SRS) (1.3)
  StatCrunch: Type 20 (say) data points into Population (say) column, Data, Sample Columns, and so on.
  stratified, cluster, systematic (convenience) sampling (1.4)
  bias or non-systematic error (non–response, response, selection) versus sampling error (1.5)

Descriptive Statistics

- distribution tables and graphs (chapter 2)
  qualitative: bar graphs, side-by-side bar graphs and Pareto charts (2.1)
  quantitative: histograms (discrete, continuous), stem-and-leaf plots (2.2)
  shape of graphs: uniform, bell-shaped, right-skewed, left-skewed (2.2)
  ogive, graphical misrepresentations (truncated scale) (2.3, 2.4)
  StatCrunch: Type 20 (say) points into var1 column, Graphics, then Bar Plot, Histogram or Stem and Leaf.

- measures of central tendency (3.1)

measure	statistic (sample, n members)	parameter (population, N members)
average (mean)	$\bar{x} = \frac{x_1+x_2+\cdots+x_n}{n} = \frac{\sum x_i}{n}$	$\mu = \frac{x_1+x_2+\cdots+x_N}{N} = \frac{\sum x_i}{N}$
median	M: middle, $\frac{n+1}{2}$, of ordered sample	middle, $\frac{N+1}{2}$, of ordered population
mode	most frequent observation in sample	most frequent observation in population

StatCrunch: Type 20 (say) points into Data (say) column, Stat, Summary Stats, Columns, and so on.

- measures of dispersion (3.2)

measure	statistic (sample, n members)	parameter (population, N members)
standard deviation	$s = \sqrt{\frac{\sum(x_i-\bar{x})^2}{n-1}}$ (definition) $= \sqrt{\frac{\sum x_i^2 - \frac{\left(\sum x_i\right)^2}{n}}{n-1}}$ (computational)	$\sigma = \sqrt{\frac{\sum(x_i-\mu)^2}{N}}$ (definition) $= \sqrt{\frac{\sum x_i^2 - \frac{\left(\sum x_i\right)^2}{N}}{N}}$ (computational)
variance	s^2	σ^2
range	$R =$ maximum $-$ minimum	maximum $-$ minimum

Stat, Summary Stats, Columns, var1, Next, select Unadj. Std Dev (σ) and Unadj. Variance (σ^2).
Empirical Rule states, *if* data is bell-shaped (mound-shaped), 68%, 95%, 99.7% of data falls within one, two, three, respectively, SDs of average.
Chebyshev's Rule states, for *any* data set, at least $1 - \frac{1}{k^2}$ proportion of data falls within k standard deviations of average.

- measures of central tendency and dispersion, grouped data (3.3)

measure	statistic (sample, n members)	parameter (population, N members)
average (mean)	$\bar{x} = \frac{x_1f_1+x_2f_2+\cdots+x_nf_n}{f_1+f_2+\cdots+f_n} = \frac{\sum x_if_i}{\sum f_i}$	$\mu = \frac{x_1f_1+x_2f_2+\cdots+x_Nf_N}{f_1+f_2+\cdots+f_N} = \frac{\sum x_if_i}{\sum f_i}$
standard deviation	$s = \sqrt{\frac{\sum(x_i-\bar{x})^2f_i}{\left(\sum f_i\right)-1}}$ (definition)	$\sigma = \sqrt{\frac{\sum(x_i-\mu)^2f_i}{\sum f_i}}$ (definition) $= \sqrt{\frac{\sum x_i^2f_i - \frac{\left(\sum x_if_i\right)^2}{\sum f_i}}{\sum f_i}}$ (computational)
variance	s^2	σ^2
median	M: middle, $\frac{n+1}{2}$, of ordered sample	middle, $\frac{N+1}{2}$, of ordered population

StatCrunch: Stat, Summary Stats, Grouped/Binned data, Bins in: category, Counts in: number, Statistics: Mean, Std. dev., Median, Compute.

- z-scores, percentiles, boxplots (3.4, 3.5)

  z-score: $z = \frac{x-\bar{x}}{s}$, (sample) $\quad z = \frac{x-\mu}{\sigma}$ (population)
  Stat Summary Stats Columns Calculate (for $\bar{x}, s$)
  Data Date Expression $(x-\bar{x})/s$ New name column: zscore Compute

  pth percentile, P_k, located $\frac{p}{100}(n+1)$
  median = 50th percentile = 2nd quartile, *located* $\frac{1}{2}(n+1)$

  five–number summary (box–and–whiskers plot):
  $\{\min, \quad P_{25} = Q_1, \quad M = P_{50} = Q_2, \quad P_{75} = Q_3, \quad \max\}$
  StatCrunch: Type 20 (say) data points into Data (say) column, Graphics, then Boxplot.

- scatter diagram (4.1)
  positive/negative, weak/moderate/strong, linear scatter
  StatCrunch: Type 20 (say) data points into Data (say) column, Graphics, then Scatter Plot.

- linear correlation coefficient, r (4.1)

$$r = \frac{\sum \left(\frac{\sum x_i - \bar{x}}{s_x}\right)\left(\frac{\sum y_i - \bar{y}}{s_y}\right)}{n-1} = \frac{SS_{xy}}{\sqrt{SS_x SS_y}} = \frac{\sum x_i y_i - \frac{\sum x_i \sum y_i}{n}}{\sqrt{\left(\sum x_i^2 - \frac{\left(\sum x_i\right)^2}{n}\right)\left(\sum y_i^2 - \frac{\left(\sum y_i\right)^2}{n}\right)}}$$

  StatCrunch: Stat, Summary Stats, Correlation, and so on.

- linear regression (4.2)

$$\hat{y} = b_1 x + b_0, \quad b_1 = r \cdot \frac{s_y}{s_x} = \frac{\sum x_i y_i - \frac{\sum x_i \sum y_i}{n}}{\sum x_i^2 - \frac{\left(\sum x_i\right)^2}{n}}, \quad b_0 = \bar{y} - b_1 \bar{x}$$

  StatCrunch: Stat, Regression, Simple Linear, and so on.

- diagnostics of linear regression (4.3)
  any patterns, other than linearity, in data,
  variance of residuals constant or not,
  outliers (boxplot),
  influential points.

- contingency tables (4.4)
  marginal, conditional distributions bar graphs,
  Simpson's paradox

Probability and Probability Distributions

- Terminology (5.1)
  sample space, S; event, E; simple event, e_i
  law of large numbers: Sample average approaches population average.
  empirical probability: $P(E) \approx \frac{\text{frequency of } E}{\text{number of trials of experiment}}$.
  classical prob: if equiprobable, $P(E) = \frac{\text{number of ways } E \text{ occurs}}{\text{number outcomes in experiment}}$.
  probability experiment: Process where outcomes assigned probabilities.
  $0 \leq P(E) \leq 1, \quad P(e_1) + P(e_2) + \cdots + P(e_n) = 1$

- And, or and complement (not) (5.2)
  common: E and F, union: E or F, complement: E^c, $P(E^c) = 1 - P(E)$

- Addition rule (5.2)
  general addition rule: $P(E \text{ or } F) = P(E) + P(F) - P(E \text{ and} F)$
  addition rule if A, B disjoint: $P(E \text{ or } F) = P(E) + P(F)$

- Independent events and multiplication rule (5.3)
  independent events: sampling with replacement
  multiplication rule: $P(E \text{ and } F \text{and } G \text{ and } \ldots) = P(E) \cdot P(F) \cdot P(G) \cdots$
  E and F are independent iff $P(E \text{ and } F) = P(E) \cdot P(F)$.
  E and F are disjoint if $P(E \text{ and } F) = 0$.

- Conditional probability (5.4)
  conditional probability: $P(F|E) = \frac{P(E \text{ and } F)}{P(E)} = \frac{P(F \text{ and } E)}{P(E)}$
  general multiplication rule: $P(E \text{ and } F) = P(E) \cdot P(F|E)$

- Counting techniques (5.5)
  multiplication rule of counting: $n_1 \cdot n_2 \cdot ...$ choices.
  permutation: ordered arrangement of r from n distinct objects: ${}_nP_r = \frac{n!}{(n-r)!}$
  combination: *un*ordered arrangement of r from n distinct objects: ${}_nC_r = \frac{n!}{r!(n-r)!}$
  permutation of n distinct objects into $n_1, n_2, \ldots, n_k$ groups: $\frac{n!}{n_1!n_2!\cdots n_k!}$
  permutation of r of n distinct items with replacement: n^r
  StatCrunch: Data, Computer expression, either fact(n), perm(n,x) or comb(n,x)

- Discrete probability distribution of random variable X, value x (6.1)
  table, graph, function, $P(x)$, $\sum P(x) = 1$, $0 \leq P(x) \leq 1$
  expected value, mean: $\mu_X = \sum [x \cdot P(x)]$
  TI–84+: type $x, P(x)$ in L_1, L_2, STAT CALC 1-Var L_1, L_2, read $\bar{x}$
  variance: $\sigma_X^2 = \sum [(x - \mu)^2 P(x)] = \sum [x^2 \cdot P(x)] - \mu_X^2$
  standard deviation: $\sigma_X = \sqrt{\sigma_X^2}$
  Stat, Calculators, Custom, Values in: x, Weights in: P(x) and so on

- Binomial distribution (6.2)
  $P(x) = P(X = x) = {}_nC_x p^x (1-p)^{n-x},\ x = 0, 1, 2 \ldots, n$
  $\mu_X = np; \quad \sigma_X^2 = np(1-p); \quad \sigma_X = \sqrt{np(1-p)}$
  fixed number trials, S/F only, independent trials, constant chance success
  Stat, Calculators, Binomial, and so on

- Poisson distribution (6.3)
  $P(x) = e^{-\lambda t} \frac{(\lambda t)^x}{x!},\ x = 0, 1, \ldots,$
  $\mu_X = \lambda t; \quad \sigma_X^2 = \lambda t; \quad \sigma_X = \sqrt{\lambda t} = \sqrt{\mu_X}$
  zero prob small interval, prob S same if same length intervals, S independent.
  Stat, Calculators, Poisson, and so on

- Normal distribution (chapter 7)
  $f(x) = \frac{1}{\sigma\sqrt{2\pi}} e^{-(1/2)[(y-\mu)/\sigma]^2}, \quad -\infty < x < \infty$
  $E(X) = \mu, \quad V(X) = \sigma^2, \quad \sigma = \sqrt{V(X)}$
  standard, nonstandard, percentage, percentile
  Stat, Calculators, Normal, and so on
  standardize normal (z–score): $z = \frac{x-\mu}{\sigma}$
  normal approximation to binomial:
  $np(1-p) \geq 10$, $\mu = np$, $\sigma = \sqrt{np(1-p)}$, continuity correction

- Uniform distribution (7.1)

- Sampling distributions
  sampling distribution: probability distribution of a statistic (8.1)
  CLT: as $n \to \infty$ (often, $n \geq 30$), $\bar{X} \to$ normal, if X random sample (8.1)
  mean: $\mu_{\bar{X}} = \mu_X, \quad \sigma_{\bar{X}}^2 = \frac{\sigma_X^2}{n}, \quad \sigma_{\bar{X}} = \frac{\sigma_X}{\sqrt{n}}$
  Stat, Calculators, Normal, and so on; use $\sigma_{\bar{X}}$ instead of σ_X
  proportion: $\hat{p} = \frac{X}{n}$, is typically normal when $np(1-p) \geq 10$
  $\mu_{\hat{p}} = p, \quad \sigma_{\hat{p}} = \sqrt{\frac{p(1-p)}{n}}$
  Stat, Calculators, Normal, and so on; use $\sigma_{\hat{p}}$

- t, χ^2 and F distributions: percentages, percentiles (critical values)
  StatCrunch: Stat, Calculators, T (9.2, 10.3, 11.1, 11.2, 14.1, 14.2)
  StatCrunch: Stat, Calculators, Chi-Square (9.4, 10.5, 12)
  StatCrunch: Stat, Calculators, F (11.4, 13.1)

Statistical Inference

- confidence interval: interval of values together act as estimate for parameter
  point estimate: single value of statistic estimates parameter

- hypothesis test:
  null H_0, alternative H_1
  left $H_0 : \mu < 0$, right $H_0 : \mu > 0$, one–sided, two–sided tests, $H_0 : \mu \neq 0$
  p-value: chance of observing test statistic or more extreme, assuming null true
  p-value approach: If p–value is smaller than level of significance, α, reject null.
  classical approach: test statistic, z_0, versus critical value, $z_{\frac{\alpha}{2}}$
  do not reject or reject null hypothesis

chosen ↓ actual →	null H_0 true	alternative H_1 true
choose null H_0	correct decision	type II error, β
choose alternative H_1	type I error, α	correct decision: power $= 1 - \beta$

1. *μ, one sample*
   - CI and test, unknown σ, normal (9.2, 10.3)
     $\bar{x} \pm t_{\frac{\alpha}{2}} \left(\frac{s}{\sqrt{n}}\right)$, $t_0 = \frac{\bar{x}-\mu_0}{s/\sqrt{n}}$ normal, no outliers or $n \geq 30$ SRS
     StatCrunch: Stat, T statistics, One sample
     sample size given margin of error, level of confidence: $n = \left(\frac{z_{\frac{\alpha}{2}} s}{E}\right)^2$

2. *p, one sample*
   - CI and test, large sample (9.1, 10.1, 10.2)
     $\hat{p} \pm z_{\frac{\alpha}{2}} \sqrt{\frac{\hat{p}(1-\hat{p})}{n}}$, $z_0 = \frac{\hat{p}-p_0}{\sqrt{\frac{p_0(1-p_0)}{n}}}$ $np_0(1-p_0) \geq 10$ SRS; finite: $n \leq 0.05N$
     StatCrunch: Stat, Proportions, One sample
     sample size given E, α: $n = \hat{p}(1-\hat{p})\left(\frac{z_{\frac{\alpha}{2}}}{E}\right)^2$ ($\hat{p}$ known), or $n = \frac{1}{4}\left(\frac{z_{\frac{\alpha}{2}}}{E}\right)^2$
   - Test (one-sided), small sample (10.2)
     StatCrunch: Stat, Calculators, Binomial $np_0(1-p_0) < 10$

3. *σ, one sample*
   - CI and test, normal sample n (9.3, 10.4)
     $\left(\frac{(n-1)s^2}{\chi^2_{\alpha/2}}, \frac{(n-1)s^2}{\chi^2_{1-\alpha/2}}\right)$, $\chi^2_0 = \frac{(n-1)s^2}{\sigma^2_0}$ normal, no outliers or $n \geq 30$ SRS
     StatCrunch: Stat, Variance, One sample

4. *μ, two samples*
   - CI and test, unknown σ_1, σ_2, dependent (paired) test (11.2)
     $\bar{d} \pm t_{\frac{\alpha}{2}} \left(\frac{s_d}{\sqrt{n}}\right)$ $t_0 = \frac{\bar{d}-\mu_d}{\frac{s_d}{\sqrt{n}}}$ $\bar{d}$ normal, no outliers or $n \geq 30$ SRS
     StatCrunch: Stat, T statistics, Paired

- CI and test, unknown σ_1, σ_2, independent, not pooled (11.3)
  $(\bar{x}_1 - \bar{x}_2) \pm t_{\frac{\alpha}{2}} \sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}}$, $t_0 = \frac{(\bar{x}_1 - \bar{x}_2) - (\mu_1 - \mu_2)}{\sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}}}$, df $= \frac{\left(\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}\right)^2}{\frac{1}{n_1 - 1}\left(\frac{s_1^2}{n_1}\right)^2 + \frac{1}{n_2 - 1}\left(\frac{s_2^2}{n_2}\right)^2}$
  both normal, no outliers or $n_1 \geq 30, n_2 \geq 30$ SRS
  StatCrunch: Stat, T statistics, Two samples, UNcheck "pool variances"

5. *p, two samples*

- CI and test, large independent samples n_1, n_2 (11.1)
  $\hat{p}_1 - \hat{p}_2 \pm z_{\frac{\alpha}{2}} \sqrt{\frac{\hat{p}_1(1-\hat{p}_1)}{n_1} + \frac{\hat{p}_2(1-\hat{p}_2)}{n_2}}$, $z_0 = \frac{(\hat{p}_1 - \hat{p}_2) - (p_1 - p_2)}{\sqrt{\frac{\hat{p}(1-\hat{p})}{n_1} + \frac{\hat{p}(1-\hat{p})}{n_2}}}$, $\hat{p} = \frac{x_1 + x_2}{n_1 + n_2}$
  $n_1\hat{p}_1(1 - \hat{p}_1) > 10$, $n_2\hat{p}_2(1 - \hat{p}_2) > 10$, if finite: $n_1 \leq 0.05N_1$, $n_2 \leq 0.05N_2$
  StatCrunch: Stat, Proportions, Two samples
  n_1, n_2 given E, α: either $n = n_1 = n_2 = [\hat{p}_1(1 - \hat{p}_1) + \hat{p}_2(1 - \hat{p}_2)]\left(\frac{z_{\frac{\alpha}{2}}}{E}\right)^2$,
  or, if no priors $\hat{p}_1, \hat{p}_2$: $n = n_1 = n_2 = \frac{1}{2}\left(\frac{z_{\frac{\alpha}{2}}}{E}\right)^2$.
- Test, dependent (matched) (11.1)
  p-value $= 2 \cdot P\left(Z \geq \frac{|f_{12} - f_{21}| - 1}{\sqrt{f_{12} + f_{21}}}\right)$, $f_{12} + f_{21} \geq 10$

6. *σ, two samples*

- Test (11.4)
  $F_0 = \frac{s_1^2}{s_2^2}$ normal, no outliers, both SRS
  StatCrunch: Stat, Variance, Two samples

7. *μ, multiple samples*

- Analysis of Variance, ANOVA test (13.1)
  $F_0 = \frac{\text{MST}}{\text{MSE}}$, $\text{MST} = \frac{\text{SST}}{k-1}$, $\text{MSE} = \frac{\text{SSE}}{n-k}$

$$\begin{aligned} \text{SST} &= n_1(\bar{x}_1 - \bar{x})^2 + n_2(\bar{x}_2 - \bar{x})^2 + \cdots + n_k(\bar{x}_k - \bar{x})^2 \\ \text{SSE} &= (n_1 - 1)s_1^2 + (n_2 - 1)s_2^2 + \cdots + (n_k - 1)s_k^2. \end{aligned}$$

  StatCrunch: Stat, ANOVA, One Way
  normal, constant σ_i, independence

8. *p, multiple samples*

- goodness of fit test: (12.1)
  $\chi_0^2 = \sum \frac{(O_i - E_i)^2}{E_i}$, $i = 1, 2, \ldots k$
  $E_i \geq 1$ and 80% of expected frequencies are at least 5
  StatCrunch: Stat, Goodness-of-fit, Chi-square test

- test of independence and test of homogeneity of proportions: (12.2)
  $\chi_0^2 = \sum \frac{(O_i - E_i)^2}{E_i}$, $\quad E_i = \frac{\text{(no. rows)} \times \text{(no. columns)}}{\text{(table total)}}$, $\quad (r-1)(c-1)$ df
  $E_i \geq 1$ and 80% of expected frequencies are at least 5
  StatCrunch: Stat, Tables, Contingency, with summary

9. *σ, multiple samples*

- not covered

10. *Summary of Confidence Intervals and Tests*

HYPOTHESIS TESTS		mean μ	variance σ^2	proportion p
	one	$t_0 = \frac{\bar{x} - \mu_0}{s/\sqrt{n}}$	$\chi_0^2 = \frac{(n-1)s^2}{\sigma_0^2}$	large: $z_0 = \frac{\hat{p} - p_0}{\sqrt{\frac{p_0(1-p_0)}{n}}}$ small: use binomial
sample	two	independent: $t_0 = \frac{(\bar{x}_1 - \bar{x}_2) - (\mu_1 - \mu_2)}{\sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}}}$	$F_0 = \frac{s_1^2}{s_2^2}$	independent: $z_0 = \frac{(\hat{p}_1 - \hat{p}_2) - (p_1 - p_2)}{\sqrt{\frac{\hat{p}(1-\hat{p})}{n_1} + \frac{\hat{p}(1-\hat{p})}{n_2}}}$ where $\hat{p} = \frac{x_1 + x_2}{n_1 + n_2}$
		dependent: $t_0 = \frac{d - \mu_d}{s_d/\sqrt{n}}$		dependent: $z_0 = \frac{\lvert f_{12} - f_{21} \rvert - 1}{\sqrt{f_{12} + f_{21}}}$
	multiple	$F_0 = \frac{\text{MST}}{\text{MSE}}$	not covered	$\chi_0^2 = \sum \frac{(O_i - E_i)^2}{E_i}$

CONFIDENCE INTERVALS		mean μ	variance σ^2	proportion p
	one	$\bar{x} \pm t_{\frac{\alpha}{2}} \left(\frac{s}{\sqrt{n}} \right)$	$\left(\frac{(n-1)s^2}{\chi^2_{\alpha/2}}, \frac{(n-1)s^2}{\chi^2_{1-\alpha/2}} \right)$	$\hat{p} \pm z_{\frac{\alpha}{2}} \sqrt{\frac{\hat{p}(1-\hat{p})}{n}}$
sample	two	indep: $(\bar{x}_1 - \bar{x}_2) \pm t_{\frac{\alpha}{2}} \sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}}$	not covered	$\hat{p}_1 - \hat{p}_2 \pm z_{\frac{\alpha}{2}} \sqrt{\frac{\hat{p}_1(1-\hat{p}_1)}{n_1} + \frac{\hat{p}_2(1-\hat{p}_2)}{n_2}}$
		dependent: $\bar{d} \pm t_{\frac{\alpha}{2}} \left(\frac{s_d}{\sqrt{n}} \right)$		
	multiple	not covered	not covered	not covered

11. Linear Regression

- Test and CI for β_1 (14.1)
  $t_0 = \frac{b_1 - \beta_1}{\frac{s_e}{\sqrt{\sum (x_i - \bar{x})^2}}} = \frac{b_1 - \beta_1}{s_{b_1}}$ $\quad b_1 \pm t_{\frac{\alpha}{2}} \left(\frac{s_e}{\sqrt{\sum (x_i - \bar{x})^2}} \right)$ $\quad$ where $s_e = \sqrt{\frac{\sum (y_i - \hat{y}_i)^2}{n-2}}$
  normal, constant variance, linearity StatCrunch: Stat, Regression, Simple Linear
- CI for mean $\hat{y}$ and PI for individual $\hat{y}$ (14.2)
  $\hat{y} \pm t_{\frac{\alpha}{2}} \cdot s_e \sqrt{\frac{1}{n} + \frac{(x^* - \bar{x})^2}{\sum (x_i - \bar{x})^2}}$ $\quad \hat{y} \pm t_{\frac{\alpha}{2}} \cdot s_e \sqrt{1 + \frac{1}{n} + \frac{(x^* - \bar{x})^2}{\sum (x_i - \bar{x})^2}}$ StatCrunch: Stat, Regression, Simple Linear, check Predict Y for X = x

Attendance	Chapter	Topics	Description
1	1	Random Number Generator	Data, Sample Columns
2	2	Histogram From Raw Data	Graphics, Histogram
2	2	Stem and Leaf Display	Graphics, Stem and Leaf
3	3	Summary Statistics	Stat, Summary Stats, Columns
3	3	Grouped data	Stat, Summary Stats, Binned/Grouped data
3	3	Box and Whiskers Plot	Graphics, Boxplot
4	4	Correlation Coefficient	Stat, Summary Stats, Correlation
4	4	Linear Regression	Stat, Regression, Simple Linear
5	5	Factorials, Permutation, Combination	Data, Computer expression: fact(n), perm(n,x), comb(n,x)
6	6	Discrete Probability Distribution	Stat, Calculators, Custom
6	6	Expected Value and Variance	Stat, Calculators, Custom
6	6	Binomial Distribution	Stat, Calculators, Binomial
6	6	Poisson Distribution	Stat, Calculators, Poisson
7	7	Normal Distribution	Stat, Calculators, Normal
7	7	Normal Probability (QQ) Plot	Graphics, QQ Plot
8	8	Sampling Distributions	Stat, Calculators, Normal
9	9	CI For Mean, Known σ	Stat, T statistics, One sample
9	9	CI For Proportion	Stat, Proportions, One sample
9	9	CT For Variance	Stat, Variance, One sample
9	9	t–distribution	Stat, Calculators, T
9	9	Chi–Square Distribution	Stat, Calculators, Chi–square
10	10	Test For Mean, Known σ	Stat, T statistics, One sample
10	10	Test For Proportion	Stat, Proportions, One sample
10	10	Test For Variance	Stat, Variance, One sample
11	11	CI/Test For Difference In Means	Stat, T statistics, Paired or Two sample
11	11	CI/Test For Difference In Proportions	Stat, Proportions, Two samples
11	11	Test of Ratio of Variances	Stat, Variance, Two samples
11	11	F Distribution	Stat, Calculators, F
12	12	Goodness of Fit	Stat, Goodness-of-fit, Chi-square test
12	12	Test of Independence/Homogeneity	Stat, Tables, Contingency, with summary
13	13	One Way Analysis of Variance	Stat, ANOVA, One Way
14	14	Standard Error of Estimate	Stat, Regression, Simple Linear
14	14	Test/CI β_1; CI/PI $\hat{y}$	Stat, Regression, Simple Linear