For all quizzes in part 3: Be sure you have **formula sheet** and **Table 1** and **Table 2**.

Quiz # 9: This quiz covers **all materials on quiz 8** plus **estimating population proportions**.

What do we estimate? **Population Proportion** ($P = ?$)
Know all the new **terminologies** and related **notations** (Point estimate $\hat{p}$, Margin of error)
Know all the new **formulas** on **formula sheet** and their related **TI commands**.
To estimate **population proportion** ($P = ?$), know how to use TI (**option A**) or (**formula** $P = \hat{p} \pm E$)

Be sure you always have Table 1 as a reference for every estimation problem

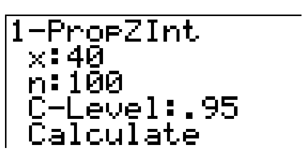
Important: If confidence level is not given use 95% as a default.

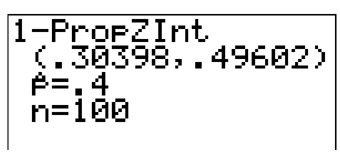
Required formula: $P = \hat{p} \pm E$ $E = z_{\alpha/2}\sqrt{\dfrac{\hat{p}(1-\hat{p})}{n}}$ and **Table 1** (see page 4)

Example 1: Use **95%** confidence Level to estimate the percentage of drivers texting while driving when in a sample of 100 drivers 40 text and drive.
First we need to find the point estimate, $\hat{P} = \dfrac{x}{n} = \dfrac{40}{100} = .40$, **from Table 1** from **page 4** for 95% confidence level the z will be 1.96 so the $E = z_{\alpha/2}\sqrt{\dfrac{\hat{p}(1-\hat{p})}{n}} = 1.96\sqrt{\dfrac{.4(1-.4)}{100}} = .096$, so now $P = .40 \pm 0.096 = 40\% \pm 9.6\%$

Final answer: We have 95% confidence that **between 30.39% to 49.6%** of drivers text while driving.

Solution by TI 83/84 Calculator ***stat ----→ test----→ option***





Example 2: In a sample of 400 applicants for DMV driving test, 280 passed on the first attempt. Find 90% confidence interval of all DMV applicants who pass DMV test on the first attempt.
First $\hat{P} = \dfrac{x}{n} = \dfrac{280}{400} = .70$, **from** Table 1 for 90% confidence level the z will be 1.645 so the

$E = z_{\alpha/2}\sqrt{\dfrac{\hat{p}(1-\hat{p})}{n}} = 1.645\sqrt{\dfrac{.7(1-.7)}{400}} = .038$ then using $P = \hat{p} \pm E = .70 \pm 0.038 = 70\% \pm 3.8\%$

Final answer: We have 90% confidence that **between 66.2% to 73.8%** of DMV applicant pass driving test on the first attempt.

Estimating Population Proportion $P = \hat{p} \pm E$	
$\hat{P} = \frac{x}{n}$ **(Called p-hat is sample proportion and point estimate for population proportion)**	**E = Margin of error** $E = z_{\alpha/2}\sqrt{\frac{\hat{p}(1-\hat{p})}{n}}$
Width (difference between upper and lower bounds**)** $= 2E = UB - LB$ **so** $E = (UB - LB)/2$ Point Estimate (middle **of upper and lower bounds**) $= \hat{p} = (UB + LB)/2$	
TI-83 ***stat*** $\rightarrow$ ***test*** $\rightarrow$ ***Option A***	

1. If 64% of a sample of 550 people leaving a shopping mall claims to have spent over \$25, determine a 99% confidence interval estimate for the proportion of shopping mall customers who spend over \$25. Interpret your interval.

$E = 2.5758\sqrt{\frac{0.64(1-0.64)}{550}} = .0527$ $\quad P = 0.64 \pm 0.0527$ $\quad 58.73\% < P < 69.27\%$

2. In a random sample of machine parts, 18 out of 225 were found to have been damaged in shipment. Establish a 95% confidence interval estimate for the proportion of machine parts that are damaged in shipment. Interpret your interval.

$\hat{p} = \frac{x}{n} = \frac{18}{225} = 0.08$ $\quad E = 1.96\sqrt{\frac{0.08(1-0.08)}{225}} = .0354$ $\quad P = 0.08 \pm 0.0354$ $\quad 4.5\% < P < 11.5\%$

3. A telephone survey of 1000 adults was taken shortly after the U.S. began bombing Iraq. If 832 voiced their support for this action. Create a 99% confidence interval and interpret the interval.

$\hat{p} = \frac{x}{n} = \frac{832}{1000} = 0.832$ $\quad E = 2.5758\sqrt{\frac{0.832(1-0.832)}{1000}} = .0305$ $\quad P = 0.832 \pm 0.0305$ $\quad 80.16\% < P < 86.25\%$

4. An assembly line does a quality check by sampling 50 of its products. It finds that 16% of the parts are defective.

a. Create a 95% confidence interval for the percent of defective parts for the company and interpret this interval.

$E = 1.96\sqrt{\frac{0.16(1-0.16)}{50}} = .102$ $\quad P = 0.16 \pm 0.102$ $\quad 0.06\% < P < 26.16\%$

b. If we decreased the confidence level to 90% **what would happen to:**

i. **the critical value?** It decreases from 1.96 to 1.645
ii. **the margin of error?** It will decrease
iii. **the confidence interval?** It will become narrower

c. If the sample size were increased to 200, the same sample proportion were found, and we did a 95% confidence interval; **what would happen to**:

i. **the critical value?** By just increasing the sample size the critical value will not change
ii. **the margin of error?** By increasing sample size, the margin of error will decrease.
iii. **the confidence interval?** By increasing sample size, the interval will be narrower.

5. A nationwide poll was taken of 1400 teenagers (ages 13-18). 630 of them said they have a TV in their room.

a. Create a 90% confidence interval for the proportion of all teenagers who have a TV in their room and interpret it.

$\hat{p} = \frac{x}{n} = \frac{630}{1400} = 0.45$ $E = 1.645\sqrt{\frac{0.45(1-0.45)}{1400}} = .0133$ $P = 0.45 \pm 0.0133$ $43.67\% < P < 46.33\%$

What does “90% confidence” mean in this context?

If we increased the confidence level to 99% **what would happen to**:

i. **the critical value?** It increases 1.645 to 2.5758

ii. **the margin of error?** It will increase.

iii. **the confidence interval?** It will become wider.

6. If the sample size were changed to 950, the same sample proportion were found, and we did a 90% confidence interval; what would happen to:

ii. **the critical value?** By just decreasing the sample size the critical value will not change

iii. **the margin of error?** It will increase

iv. **the confidence interval?** It will become wider.

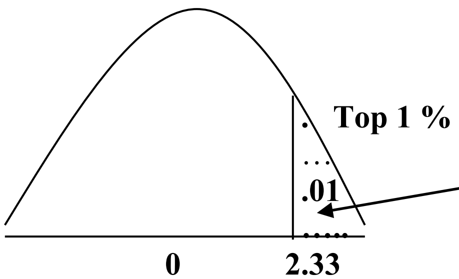
7. Suppose a 90% confidence interval is stated as (0.3011, 0.4189).

a. What is the sample proportion from this sample? $\hat{p} = (UB + LB) / 2 = (0.4189 + 0.3011) / 2 = 0.36$

b. What is the margin of error? $E = (UB - LB) / 2 = (0.4189 - 0.3011) / 2 = 0.0580$

Based on Standard Normal Distribution $\mu = 0$ and $\sigma = 1$

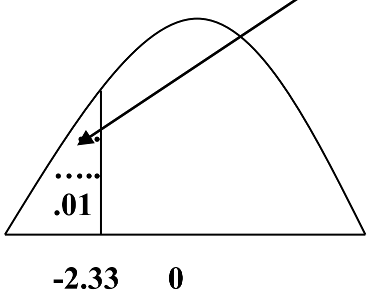
Out Side Area



OR

Out Side Area

Bottom 1 %

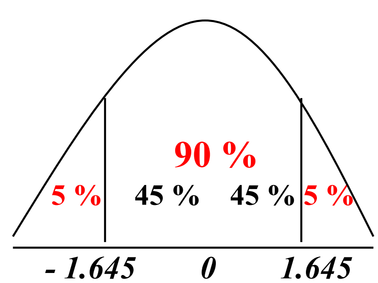


Confidence Level	Out Side Area On left or right Cut-off Point	Z - Value (±) Critical Value $= Z_{\alpha/2}$
99%	.005	± 2.5758
98%	.01	±2.3263
97%	.015	±2.1701
96%	.02	±2.0537
95%	.025	±1.9600
94%	.03	±1.8808
92%	.04	±1.7507
90%	.05	±1.6450
88%	.06	±1.5548
86%	.07	±1.4758
84%	.08	±1.4051
82%	.09	±1.3408
80%	.10	±1.2816
78%	.11	±1.2265
76%	.12	±1.1750
70%	.15	±1.0364
60%	.20	±0.8416
50%	.25	±0.6749
40%	.30	±0.5244

How to find the Z -value for confidence intervals.

Example: Find the Z - value for 90% confidence interval

1. Divide 90% = 0.90 by 2, $\Rightarrow$ $.90 / 2 = 0.45$
2. Subtract 0.45 from 0.5 $\Rightarrow$ $.5 - 0.45 = .05$
3. Look for area close to 0.05from **inside** the table (page1).
4. ***Find its corresponding Z-value (- 1.645)***



TI-83/84 ***2nd → Distr → Option 3*** *input (% ,0 ,1)*

Example*: *2nd → Distr → Option 3 *input (.05 ,0 ,1) enter , then the answer will be - 1.645*

Example*: *2nd → Distr → Option 3 *input (.95 ,0 ,1) enter, then the answer will be 1.645*

Hint for TI ***% is the area to the left of the cut off point.***