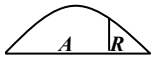
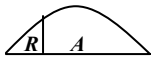
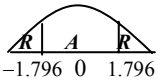
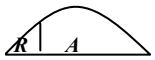
	Step 1	Step 2	Step 3	Test Statistics (*ts*)	Conclusion About H_0	Comment About SC
1	**SC**: $\mu > 40$ **OC**: $\mu \le 40$	**H_0**: $\mu \le 40$ **H_1**: $\mu > 40$ RTT	$\alpha = .05,\ n = 49$ RTT  **CV** = 1.645	$n = 49,\quad \bar{x} = 41.8,\quad s = 3.8$ $ts = z = \dfrac{\sqrt{49}(41.8 - 40)}{3.8} = 3.316$	***ts*** falls inside ***CR*** $\Rightarrow$ Reject that **H_0**: $\mu \le 40$	Accept **SC**: $\mu > 40$
2	**SC**: $\mu \ne 40$ **OC**: $\mu = 40$	**H_0**: $\mu = 40$ **H_1**: $\mu \ne 40$ TTT	$\alpha = .01\ \ n = 49$ TTT TTT  **CV** = ± 2.576	$n = 49,\quad \bar{x} = 42.8,\quad s = 4.8$ $ts = z = \dfrac{\sqrt{49}(42.8 - 40)}{4.8} = 4.08$	***ts*** falls inside ***CR*** $\Rightarrow$ Reject that **H_0**: $\mu = 40$	Accept **SC**: $\mu \ne 40$
3	**SC**: $\mu < 40$ **OC**: $\mu \ge 40$	**H_0**: $\mu \ge 40$ **H_1**: $\mu < 40$ LTT	$\alpha = .01\ \ n = 56$ RTT  **CV** = −2.326	$n = 56,\quad \bar{x} = 39.5,\quad s = 1.9$ $ts = z = \dfrac{\sqrt{56}(39.5 - 40)}{1.9} = -1.969$	***ts*** falls not inside ***CR*** $\Rightarrow$ Accept that **H_0**: $\mu \ge 40$	Reject **SC**: $\mu < 40$
4	**SC**: $\mu < 40$ **OC**: $\mu \ge 40$	**H_0**: $\mu \ge 40$ **H_1**: $\mu < 40$ LTT	$\alpha = .05,\ n = 16$ LTT  **CV** = −1.753	$n = 16,\quad \bar{x} = 38.5,\quad s = 2.2$ $ts = t = \dfrac{\sqrt{16}(38.5 - 40)}{2.2} = -2.727$	***ts*** falls inside ***CR*** $\Rightarrow$ Reject that **H_0**: $\mu \ge 40$	Accept **SC**: $\mu < 40$
5	**SC**: $\mu = 15$ **OC**: $\mu \ne 15$	**H_0**: $\mu = 15$ **H_1**: $\mu \ne 15$ TTT	$\alpha = .10,\ n = 12$ TTT TTT  **CV** = ± 1.796	$n = 12,\quad \bar{x} = 13.8,\quad s = 2.7$ $ts = t = \dfrac{\sqrt{12}(13.8 - 15)}{2.7} = -1.54$	***ts*** falls not inside ***CR*** $\Rightarrow$ Accept that **H_0**: $\mu = 15$	Accept **SC**: $\mu = 15$
6	**SC**: $p > 0.40$ **OC**: $p \le 0.40$	**H_0**: $p \le 0.40$ **H_1**: $p > 0.40$ RTT	$\alpha = .01,\ n = 250$ RTT  **CV** = 2.326	$n = 250,\quad x = 120,\quad \hat{p} = 120/250 = .48$ $ts = z = \dfrac{.48 - .40}{\sqrt{\dfrac{.4(1-.4)}{250}}} = 2.57$	***ts*** falls inside ***CR*** $\Rightarrow$ Reject that **H_0**: $p \le 0.40$	Accept **SC**: $p > .40$
7	**SC**: $p \ge 0.40$ **OC**: $p < 0.40$	**H_0**: $p \ge 0.40$ **H_1** $p < 0.40$ LTT	$\alpha = .05,\ n = 360$ LTT  **CV** = −1.645	$n = 360,\quad x = 140,\quad \hat{p} = 140/360 = .38$ $ts = z = \dfrac{.38 - .40}{\sqrt{\dfrac{.4(1-.4)}{360}}} = -.775$	***ts*** falls not inside ***CR*** $\Rightarrow$ Accept that **H_0**: $p \ge 0.40$	Accept **SC**: $p \ge .40$

Please complete the table

	Step 1	Step 2	Step 3	Test Statistics = ts	Conclusion	Comment
1	**SC**: $\mu = 41$ **OC**:	$\mathbf{H_0}$: $\mathbf{H_1}$:	$\alpha = .01$, $n = 36$  **0** CV = ? =	$n = 36$, $\bar{x} = 44.8$, $s = 3.2$ $ts =$ ————	***ts*** falls inside of ***CR or not ?*** ⇒ **R**eject **or** **A**ccept $\mathbf{H_0}$?	Accept **or** Reject that **SC**:
2	**SC**: $\mu \leq 55$ **OC**:	$\mathbf{H_0}$: $\mathbf{H_1}$:	$\alpha = 0.1$ $n = 64$  **0** CV = ? =	$n = 64$, $\bar{x} = 56.2$, $s = 8.4$ $ts =$ ————	***ts*** falls inside of ***CR or not ?*** ⇒ **R**eject **or** **A**ccept $\mathbf{H_0}$?	Accept **or** Reject that **SC**:
3	**SC**: $\mu \neq 14$ **OC**:	$\mathbf{H_0}$: $\mathbf{H_1}$:	$\alpha = .05$ $n = 20$  **0** CV = ? =	$n = 20$, $\bar{x} = 13.12$, $s = 3.2$ $ts =$ ————	***ts*** falls inside of ***CR or not ?*** ⇒ **R**eject **or** **A**ccept $\mathbf{H_0}$?	Accept **or** Reject that **SC**:
4	**SC**: $\mu \geq 400$ **OC**:	$\mathbf{H_0}$: $\mathbf{H_1}$:	$\alpha = .025$, $n = 25$  **0** CV = ? =	$n = 25$, $\bar{x} = 355$, $s = 22$ $ts =$ ————	***ts*** falls inside of ***CR or not ?*** ⇒ **A**ccept **or** **R**eject $\mathbf{H_0}$?	Accept **or** Reject that **SC**:
5	**SC**: $\mu < 102$ **OC**:	$\mathbf{H_0}$: $\mathbf{H_1}$:	$\alpha = .01$, $n = 82$  **0** CV = ? =	$n = 82$, $\bar{x} = 97.5$, $s = 17.521$ $ts =$ ————	***ts*** falls inside of ***CR or not ?*** ⇒ **R**eject **or** **A**ccept $\mathbf{H_0}$?	Accept **or** Reject that **SC**:
6	**SC**: $p \neq 0.13$ **OC**:	$\mathbf{H_0}$: $\mathbf{H_1}$:	$\alpha = .05$, $n = 400$  **0** CV = ? =	$n = 400$, $x = 64$ $\hat{p} =$ $ts =$ ————	***ts*** falls inside of ***CR or not ?*** ⇒ **R**eject **or** **A**ccept $\mathbf{H_0}$?	Accept **or** Reject that **SC**:
7	**SC**: $p > 0.44$ **OC**:	$\mathbf{H_0}$: $\mathbf{H_1}$:	$\alpha = .01$, $n = 200$  **0** CV = ? =	$n = 200$, $x = 92$, $\hat{p} =$ $ts =$ ————	***ts*** falls inside of ***CR or not ?*** ⇒ **R**eject **or** **A**ccept $\mathbf{H_0}$?	Accept **or** Reject that **SC**:

Answers on page 10

Hypotheses about μ

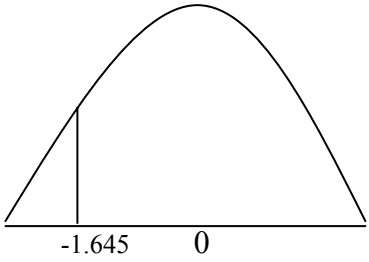
Large and Small sample

P. 1) Leno Co. claims that the mean life of their batteries is at least 60 months. Test this claim with significance level $\alpha = .05$, when a sample of 36 batteries has an average life of 57.5 months with st. dev. of 16 months.

Stated Claim: $\mu \geq 60$ Ho: $\mu \geq 60$ $n = 36$ $\overline{x} = 57.5$ $s = 16$

Opposing Claim: $\mu < 60$ $H_{1:}\ \mu < 60$

CV = -1.645



Test Statistic: = ***ts*** = $z = \dfrac{\sqrt{n}(\overline{x} - \mu)}{s} = \dfrac{\sqrt{36}(57.5 - 60)}{16} = -0.938$ ***Falls not inside CR***

Conclusion: Accept or reject $\mathbf{H_0}$? Accept Ho:

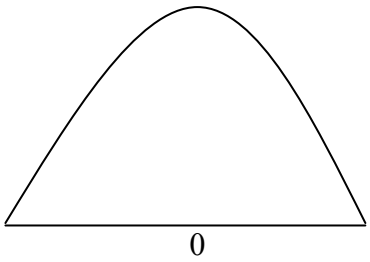
Comment: Accept or reject **SC**? Accepting that the mean life of batteries is at least 60 months.

P. 2) Leno Co. claims that the mean life of their batteries is at least 60 months. Test this claim with significance level $\alpha = .05$, if a sample of 25 batteries has mean life of 57.5 months with standard deviation of 16 months.

SC: μ Ho: μ $n =$ $\overline{x} =$ $s =$

OC: μ $H_{1:}\ \mu$

CV =



Test Statistic = ***ts*** = _____

Conclusion: Accept or reject $\mathbf{H_0}$?

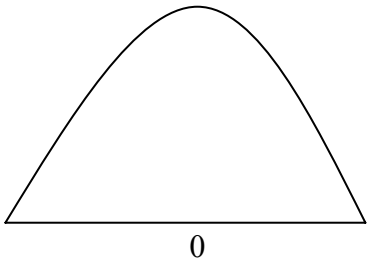
Comment: Accept or reject **SC**?

P. 3) Leno Co. claims that the mean life of their batteries is more than 60 months. Test this claim when a sample of 25 batteries has an average life of 62.3 months and standard deviation of 4 months with $\alpha = .025$.

SC: Ho: $n =$ $\overline{x} =$ $s =$

OC: $H_{1:}$

CV =



Test Statistic: = _____

Conclusion: Reject or fail to reject **Ho**?

Comment: Accept or reject **SC**?

P. 4) Leno Co. claims that the mean life of their batteries is at most 60 months. Test this claim with significance level 0.10, if a sample of 36 batteries has mean life of 64.8 months with standard deviation of 12 months.

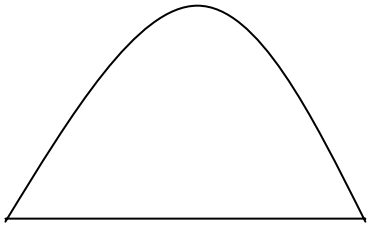
SC: Ho: $n =$ $\overline{x} =$ $s =$

OC: $H_{1:}$

CV =

Test Statistic = ***ts*** = _____

Conclusion*:* Accept or reject $\mathbf{H_0}$?



0

Comment: Accept or reject **SC**?

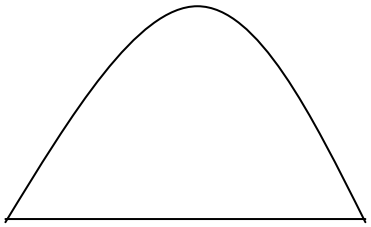
P. 5) Leno Co. claims that their batteries have an average life of 60 months. Test this claim when a sample of 36 batteries has mean life of 57.5 months with standard deviation of 6 months. $\alpha = 0.01$

SC: Ho: $n =$ $\overline{x} =$ $s =$

OC: $H_{1:}$

CV =

Test Statistic = ***ts*** = _____



Conclusion: Accept or reject $\mathbf{H_0}$? 0

Comment: Accept or reject **SC**?

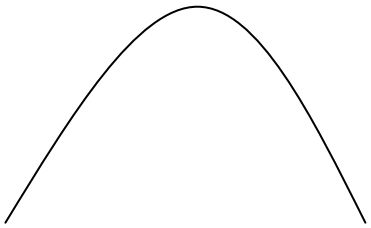
P. 6) Leno Co. claims that their batteries have an average life of 60 months. Test this claim if a sample of 25 batteries has mean life of 63.5 months with standard deviation of 8 months. $\alpha = 0.05$

SC: Ho: $n =$ $\overline{x} =$ $s =$

OC: $H_{1:}$

CV =

Test Statistic = ***ts*** = _____



0

Conclusion: Accept or reject $\mathbf{H_0}$?

Comment: Accept or reject **SC**?

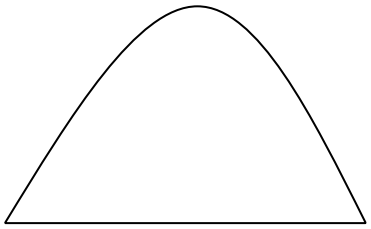
P. 7) Leno Co claims that the mean life of their batteries is less than 60 months. Test this claim when a sample of 49 batteries has mean life of 53.6 months with standard deviation of 20 months. $\alpha = 10\%$.

SC: Ho: $n =$ $\bar{x} =$ $s =$

OC: $H_{1:}$

***CV*=**

***Test Statistic*= *ts* =** _____



Conclusion: Accept or reject $\mathbf{H_0}$?

Comment: Accept or reject **SC**?

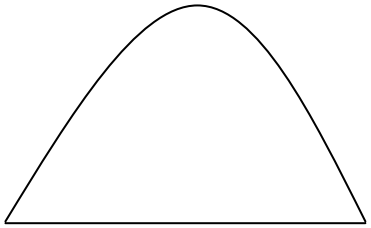
P. 8) Leno Co. claims that the mean life of their batteries is less than 60 months. Test this claim with $\alpha = 5\%$, if a sample of 16 batteries has mean life of 52.4 months with standard deviation of 14 months.

SC Ho: $n =$ $\bar{x} =$ $s =$

OC: $H_{1:}$

***CV*=**

***Test Statistic* = *ts* =** _____



Conclusion Accept or reject $\mathbf{H_0}$?

Comment: Accept or reject **SC**?

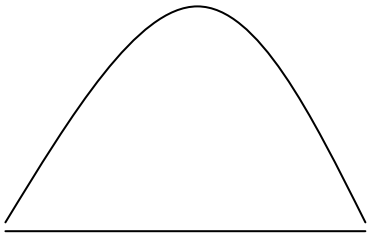
P. 9) Leno Co. claims that the mean life of their batteries is more than 60 months. Test this claim with $\alpha = .10$, if a sample of 9 batteries has a life of 62, 58, 59, 64, 63, 61, 59, 62, 58 months.

SC: Ho: $n =$ $\bar{x} =$ $s =$

OC: $H_{1:}$

***CV*=**

***Test Statistic* = *ts* =** _____



Conclusion: Accept or reject $\mathbf{H_0}$?

Comment: Accept or reject **SC**?

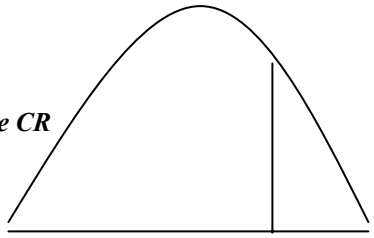
Hypotheses about P (%)

P. 10) DMV claims that more than 65 % of applicants for driving tests pass the very first time. To test this claim if out of a sample of 250 applicants only 164 passed the driving test. Is DMV's claim valid? $\alpha = 0.05$,

SC: $P > 0.65$ Ho: $P \le 0.65$ $n =$ $x =$ $\hat{p} = \frac{164}{250} = 0.656$

OC: $P \le 0.65$ H_1: $P > 0.65$

Test Statistic $= Z = \dfrac{\hat{p} - p}{\sqrt{\dfrac{p(1-p)}{n}}} = \dfrac{.656 - .65}{\sqrt{\dfrac{.65(1-.65)}{250}}} = \dfrac{.006}{.0302} = 0.199$ ***Falls not inside CR***



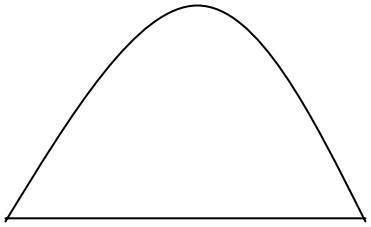
Conclusion: Accept or reject $\mathbf{H_0}$? 0 ***1.645***

Comment: Accept or reject **SC**?

P. 11) DMV claims that 65% of applicants for driving tests pass the very first time. To test this claim with $\alpha = 0.01$, out of a sample of 400 applicants 280 passed the driving test. Is DMV's claim valid?

SC: Ho: $n =$ $x =$ $\hat{p} = \frac{\quad}{400} =$

OC: H_1:



Test Statistic: _____

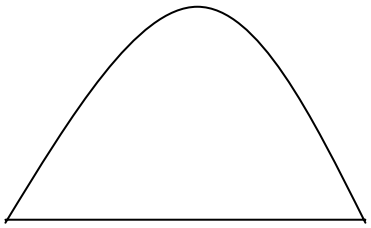
Conclusion: Accept or reject $\mathbf{H_0}$? 0

Comment: Accept or reject **SC**?

P. 12) DMV claims at most 55 % of applicants for driving tests pass the very first time. To test this claim with $\alpha = .025$ out of a sample of 300 applicants only 186 passed the driving test. Is DMV's claim valid?

SC: Ho: $n =$ $x =$ $\hat{p} = -$

OC: H_1:



Test Statistic = ***ts*** = _____

Conclusion: Accept or reject $\mathbf{H_0}$?

Comment: Accept or reject **SC**? 0

Two Independent Populations

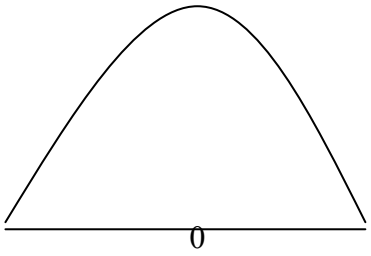
P. 13) According to data published, in 2003 the average starting salary for accountant majors was $39,560 and the starting salary for marketing majors was $41,050. Suppose these mean starting salaries are based on a random samples of 64 accountant majors, and 81 marketing majors, and further assume that the st. deviation for the starting salaries of these majors were $3560 and $3880, respectively in 2003. **Test** at 1% significance level whether the 2003 mean starting salary for all accountant majors is less than that for all marketing majors.

Accountant major (μ_1) $n_1 =$ $\bar{x}_1 =$ $s_1 =$

Marketing majors (μ_2) $n_2 =$ $\bar{x}_2 =$ $s_2 =$

SC: $\mu_1 < \mu_2$ H_0: H_0 :

OC: H_1 : H_1:



CV $= Z =$

Test Statistic $=$ ***ts*** $= z = \dfrac{(\bar{x}_1 - \bar{x}_2) - 0}{\sqrt{\dfrac{s_1^2}{n_1} + \dfrac{s_2^2}{n_2}}} =$

Conclusion: Accept or reject $\mathbf{H_0}$?

Comment: Accept or reject **SC**?

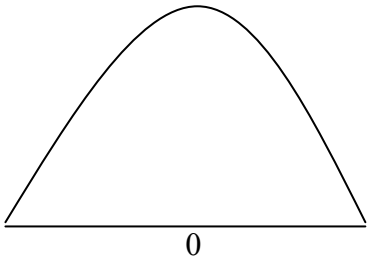
P. 14) The management at the New Century Bank claims that the mean waiting time for all customers as its branch is not different than the Public Bank, which is its main competitor. A business consulting firm took a sample of 200 customers from the New Century Bank and found out that they waited an average of 4.5 minutes with a standard deviation of 1.2 minutes before being served. Another sample of 300 customers taken from the Public Bank showed that these customers waited an average of 4.75 minutes with a standard deviation of 1.5 minutes before being served.
Test at 2. % significance level whether the claim of the management of the New Century Bank is true.

New Century Bank (μ_1) $n_1 =$ $\bar{x}_1 =$ $s_1 =$

Public Bank (μ_2) $n_2 =$ $\bar{x}_2 =$ $s_2 =$

SC: H_0: H_0 :

OC: H_1 : H_1:



CV $= Z =$

Test Statistic $=$ ***ts*** $= z = \dfrac{(\bar{x}_1 - \bar{x}_2) - 0}{\sqrt{\dfrac{s_1^2}{n_1} + \dfrac{s_2^2}{n_2}}} =$

Conclusion: Accept or reject $\mathbf{H_0}$?

Comment: Accept or reject **SC**?

Paired Samples

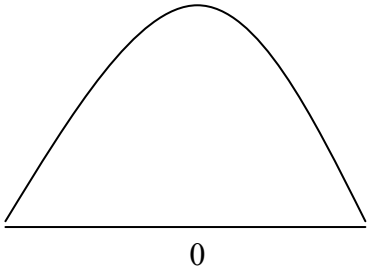
P. 15) A course is intended ***to increase*** the self-confidence of company's employees. A random sample of seven employees was evaluated for their self-confidence salesperson before and after this course.
The following table shows the measured of self-confidence scores before and after this course:

Before	8	5	4	9	6	9	5	
After	10	8	5	11	6	7	9	
d=A - B								Σd = $\bar{d}$ = s_d =

Using the 5% significance level, can you conclude that attending this course increases the self-confidence of company's employees?

SC: After the course the H_0 :

OC.: After the course the H_1 :



CV $= t =$

Test Statistic = ***ts*** = $t = \dfrac{\sqrt{n}(\bar{d} - \mu_d)}{s_d} =$

Conclusion: Accept or reject $\mathbf{H_0}$?

Comment: Accept or reject **SC**?

P. 16) A company claims that its 12-week special exercise program significantly reduces weight. A random sample of six persons was selected, and these persons were put on this exercise program for 12 weeks.
The following table gives the weight (in pounds) of these six persons before and after the program.

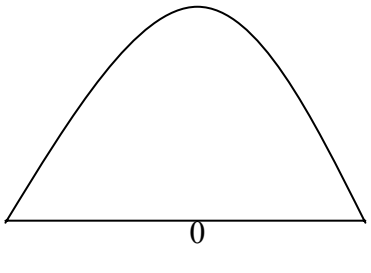
Before	180	195	177	221	208	199	
After	183	187	161	204	197	189	
d=A - B							Σd = $\bar{d}$ = s_d =

Using the 1% significance level, can you conclude that attending this exercise program reduces the weight of participants?

SC: After the course the H_0 :

OC: After the course the H_1 :

CV = $t =$



Test Statistic = $t =$

Conclusion: Accept or reject $\mathbf{H_0}$?

Comment: Accept or reject **SC**?

Multinomial

P. 17) The following table lists the grade distribution for a sample of 80 students for stat class,

Grade	A	B	C	D	F	Total
O(Observed) = Students	16	17	18	15	14	80

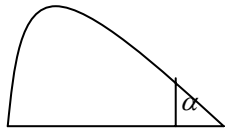
Using the 5% significance level, test the hypothesis that the proportions of grades are the same for stat. students?
Hint: to find the expected values we divide total (80) by 5.

Grade	A	B	C	D	F	Total
O(Observed) = Students	16	17	18	15	14	80
E(Expected) =Students						80
$(O-E)^2$						
$(O-E)^2 / E$						$\chi^2 = \sum \frac{(O-E)^2}{E} =$

H₀:
H₁:

K= , degrees of freedom = , **α = 5%** Critical value = $\chi^2 =$

Test statistics = $\chi^2 =$



***Conclusion*:**

Comment:

P.18) In year 2003, it is reported that based on the modes of transportation used to commute to work, 79.6% of the respondents said that they drive alone, 11.1% car pool, 5.1% use public transit, and 4.2% depend on other modes of transit. A recent 1000 randomly selected workers were asked what mode of transportation they use to commute to work. The following table lists the results of survey.

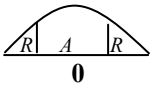
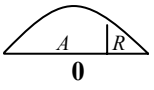
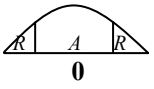
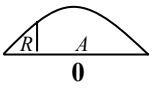
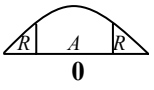
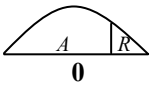
Modes of Transportation	Drive alone	Car pool	Public	Transit	Other	Total
Workers (Observed) **O**	812	102	57	29		**1000**

Test at 2.5% significance level whether the current pattern of use of transportation modes is different than for 2003.

H₀: The current percentage distribution is …
H₁: The current percentage distribution is …

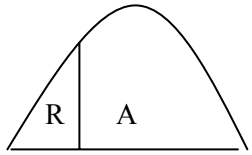
Modes of Transportation	Drive alone	Car pool	Public	Transit	Other	Total
Workers (Observed) **O**	812	102	57	29		**1000**
Workers (Expected) **E**						**1000**
$(O-E)^2$						
$(O-E)^2 / E$						$\chi^2 = \sum \frac{(O-E)^2}{E} =$

Answers To Practice Problems

	Step 1	Step 2	Step 3	Test Statistics = ts	Conclusion	Comment
1	**SC**: $\mu = 41$ **OC**: $\mu \neq 41$	$\mathbf{H_0}$: $\mu = 41$ $\mathbf{H_1}$: $\mu \neq 41$	$\alpha = .01$, $n = 36$  **CV** = ± 2.756	$n = 36$, $\bar{x} = 44.8$, $s = 3.2$ $ts = z = \dfrac{\sqrt{36}(44.8 - 41)}{3.2} = 7.125$	***ts*** falls inside of ***CR*** ⇒ **R**eject $\mathbf{H_0}$ $\mu = 41$	Reject that **SC**: $\mu = 41$
2	**SC**: $\mu \leq 55$ **OC**: $\mu > 55$	$\mathbf{H_0}$: $\mu \leq 55$ $\mathbf{H_1}$: $\mu > 55$	$\alpha = 0.1$ $n = 64$  **CV** = 2.326	$n = 64$, $\bar{x} = 56.2$, $s = 8.4$ $ts = z = \dfrac{\sqrt{64}(56.2 - 55)}{8.4} = 1.1429$	***ts*** falls not inside of ***CR*** ⇒ **A**ccept $\mathbf{H_0}$ $\mu \leq 55$	Accept that **SC**: $\mu \leq 55$
3	**SC**: $\mu \neq 14$ **OC**: $\mu = 14$	$\mathbf{H_0}$: $\mu = 14$ $\mathbf{H_1}$: $\mu \neq 14$	$\alpha = .05$ $n = 20$  **CV** = ± 2.03	$n = 20$, $\bar{x} = 13.12$, $s = 3.2$ $ts = t = \dfrac{\sqrt{20}(13.12 - 14)}{3.2} = -1.2298$	***ts*** falls not inside of ***CR*** ⇒ **A**ccept $\mathbf{H_0}$ $\mu = 14$	Reject that **SC**: $\mu \neq 14$
4	**SC**: $\mu \geq 400$ **OC**: $\mu < 400$	$\mathbf{H_0}$: $\mu \geq 400$ $\mathbf{H_1}$: $\mu < 400$	$\alpha = .025$, $n = 25$  **CV** = –2.064	$n = 25$, $\bar{x} = 355$, $s = 22$ $ts = t = \dfrac{\sqrt{25}(355 - 400)}{22} = -10.2273$	***ts*** falls inside of ***CR*** ⇒ **R**eject $\mathbf{H_0}$ $\mu \geq 400$	Reject that **SC**: $\mu \geq 400$
5	**SC**: $\mu < 102$ **OC**: $\mu \geq 102$	$\mathbf{H_0}$: $\mu \geq 102$ $\mathbf{H_1}$: $\mu < 102$	$\alpha = .01$, $n = 82$  **CV** = –2.326	$n = 82$, $\bar{x} = 97.5$, $s = 17.521$ $ts = z = \dfrac{\sqrt{82}(97.5 - 102)}{17.521} = -2.3257$	***ts*** falls on the border line of ***CR*** ⇒ **I**nconclusive	**SC**: **I**nconclusive
6	**SC**: $p \neq 0.13$ **OC**: $p = 0.13$	$\mathbf{H_0}$: $p = 0.13$ $\mathbf{H_1}$: $p \neq 0.13$	$\alpha = .05$, $n = 400$  **CV** = ±1.96	$n = 400$, $x = 64$ $\hat{p} = 64 / 400 = .16$ $ts = z = \dfrac{.16 - .13}{\sqrt{\frac{.13(1 - .13)}{400}}} = 1.784$	***ts*** falls ***not*** inside of ***CR*** ⇒ **A**ccept $\mathbf{H_0}$	Reject that **SC**: $p \neq 0.13$
7	**SC**: $p > 0.44$ **OC**: $p \leq 0.44$	$\mathbf{H_0}$: $p \leq 0.44$ $\mathbf{H_1}$: $p > 0.44$	$\alpha = .01$, $n = 200$  **CV** = 2.326	$n = 200$, $x = 92$, $\hat{p} = 92 / 200 = .46$ $ts = z = \dfrac{.46 - .44}{\sqrt{\frac{.44(1 - .44)}{200}}} = 0.5698$	***ts*** falls ***not*** inside of ***CR*** ⇒ **A**ccept $\mathbf{H_0}$	Reject that **SC**: $p > 0.44$

Practice 2.

SC: $\mu \geq 60$ Ho: $\mu \geq 60$ $n = 25$ $\bar{x} = 57.5$ $s = 16$
OC: $\mu < 60$ $H_{1:}\ \mu < 60$

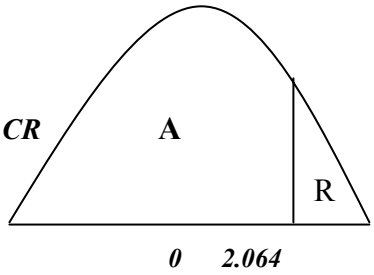


CV = $t = -1.711$ **TS** $= t = \dfrac{\sqrt{n}(\bar{x} - \mu)}{s} = \dfrac{\sqrt{25}(57.5 - 60)}{16} = -0.781$

Conclusion*:* Accept Ho **Comment**: Company's claim is true.

Practice 3.

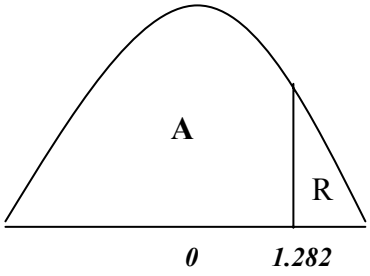
SC: $\mu > 60$ Ho: $\mu \leq 60$ $n = 25$ $\bar{x} = 62.3$ $s = 4$
OC: $\mu \leq 60$ $H_{1:}\ \mu > 60$



CV = $t = 2.064$ **TS**: $= t = \dfrac{\sqrt{n}(\bar{x} - \mu)}{s} = \dfrac{\sqrt{25}(62.3 - 60)}{4} = 2.875 \Rightarrow$ ***It falls inside CR***

Conclusion*:* Reject Ho **Comment**: Company's claim is true

Practice 4. **SC**: $\mu \leq 60$ Ho: $\mu \leq 60$ $n = 36$ $\bar{x} = 64.8$ $s = 12$
OC: $\mu > 60$ $H_{1:}\ \mu > 60$

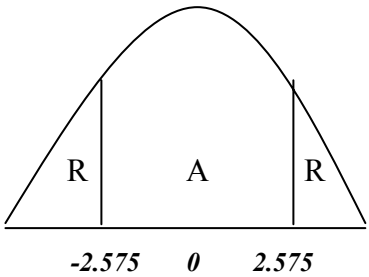


CV = $z = 1.282$ **Test Statistic**: $z = \dfrac{\sqrt{36}(64.8 - 60)}{12} = 2.4 \Rightarrow$ ***It falls inside CR***

Conclusion: Reject Ho **Comment**: Company's claim is false.

Practice 5.

SC: $\mu = 60$ Ho: $\mu = 60$ $n = 36$ $\bar{x} = 57.5$ $s = 6$
OC: $\mu \neq 60$ $H_{1:}\ \mu \neq 60$



CV = $z = \pm\ 2.575$

TS = $z = \dfrac{\sqrt{36}(57.5 - 60)}{6} = -2.5$ $\Rightarrow$ ***Falls not inside CR***

Conclusion: Accept Ho

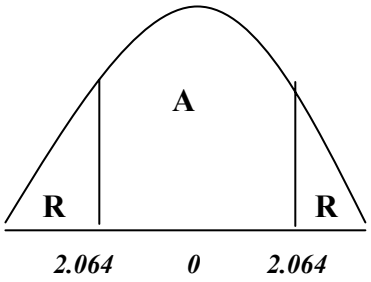
Comment: Accepting that the mean life of batteries is 60 months, so company's claim is true.

Practice 6.

SC: $\mu = 60$ Ho: $\mu = 60$ $n = 25$ $\bar{x} = 63.5$ $s = 8$

OC: $\mu \neq 60$ H_1: $\mu \neq 60$

CV = $= \pm 2.064$



TS = $t = \dfrac{\sqrt{25}(63.5-60)}{8} = 2.19$ $\Rightarrow$ ***It falls inside CR***

Conclusion: Reject Ho **Comment**: Reject the company's claim

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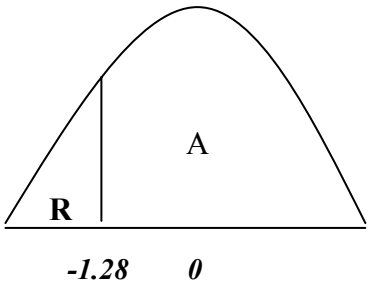
Practice 7.

SC: $\mu < 60$ Ho: $\mu \geq 60$ $n = 49$ $\bar{x} = 53.6$ $s = 20$

OC: $\mu \geq 60$ H_1: $\mu < 60$

CV $= z = -1.28$



TS $= z = \dfrac{\sqrt{49}(53.6-60)}{20} = -2.24$ $\Rightarrow$ ***It falls inside CR***

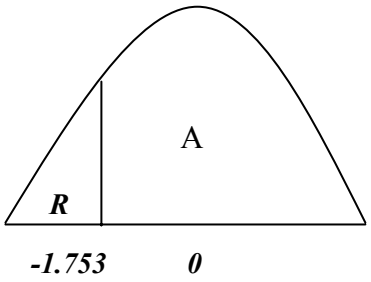
Conclusion*:* Reject Ho **Comment**: Accept the company's claim.

Practice 8.

SC*:* $\mu < 60$ Ho: $\mu \geq 60$ $n = 16$ $\bar{x} = 52.4$ $s = 14$

OC: $\mu \geq 60$ H_1: $\mu < 60$

CV: $= t = -1.753$



TS $= t = \dfrac{\sqrt{16}(52.4-60)}{14} = -2.17$ $\Rightarrow$ ***It falls inside CR***

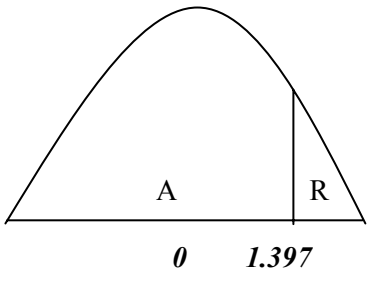
Conclusion Reject Ho **Comment**: Accept the company's claim.

Practice 9.

SC: $\mu > 60$ Ho: $\mu \leq 60$ $n = 9$ $\bar{x} = 60.66$ $s = 2.24$

OC: $\mu \leq 60$ H_1: $\mu > 60$

CV $= t = 1.397$ **TS** $= = t = \dfrac{\sqrt{9}(60.66-60)}{2.24} = 0.884$ $\Rightarrow$ ***Falls not inside CR***

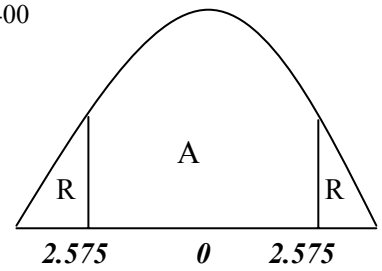


Conclusion*:* Accept Ho **Comment**: Reject the company's claim.

Practice 11. **Hypotheses about** P (%)

SC: $P = 0.65$ Ho: $P = 0.65$ $n = 400$ $x = 280$ $\hat{p} = \frac{280}{400} = 0.7$

OC: $P \neq 0.65$ H_1: $P \neq 0.65$



CV $= z = \pm\ 2.575$

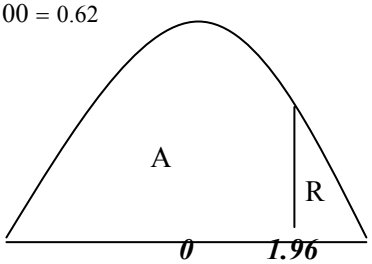
TS: $Z = \dfrac{\hat{p} - p}{\sqrt{\dfrac{p(1-p)}{n}}} = \dfrac{0.70 - .65}{\sqrt{\dfrac{.65(1-.65)}{400}}} = \dfrac{.05}{.0238} = 2.10 \Rightarrow$ ***Falls not inside CR***

Conclusion: Accept Ho **Comment**: DMV's claim is true

Practice 12.

SC: $P \leq 0.55$ Ho: $P \leq 0.55$ $n = 300$ $x = 186$ $\hat{p} = 186/300 = 0.62$

OC: $P > 0.55$ H_1: $P > 0.55$



CV $= z = 1.96$

TS: $Z = \dfrac{\hat{p} - p}{\sqrt{\dfrac{p(1-p)}{n}}} = \dfrac{0.62 - 0.55}{\sqrt{\dfrac{.55(1-.55)}{300}}} = \dfrac{0.07}{.0287} = 2.44 \Rightarrow$ ***It falls inside CR***

Conclusion: Reject Ho **Comment**: DMV's claim is false.

Two Independent Populations

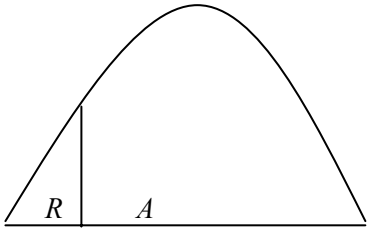
Practice 13.

Accountant major (μ_1) $n_1 = 64$ $\bar{x}_1 = 39560$ $s_1 = 3560$

Marketing majors (μ_2) $n_2 = 81$ $\bar{x}_2 = 41050$ $s_2 = 3880$

SC: $\mu_1 < \mu_2$ H_0: $\mu_1 \geq \mu_2$ H_0 : $\mu_1 - \mu_2 \geq 0$

OC: $\mu_1 \geq \mu_2$ H_1 : $\mu_1 < \mu_2$ H_1: $\mu_1 - \mu_2 < 0$



Critical value (From Table) **Z** $= -2.326$

TS $= z = \dfrac{(\bar{x}_1 - \bar{x}_2) - 0}{\sqrt{\dfrac{s_1^2}{n_1} + \dfrac{s_2^2}{n_2}}} = \dfrac{(39560 - 41050) - 0}{\sqrt{\dfrac{3560^2}{64} + \dfrac{3880^2}{81}}} = -2.4$

$\Rightarrow$ ***It falls inside CR*** **Conclusion: R**eject H_0 **Comment:** Accept that $\mu_1 < \mu_2$

Practice 14.

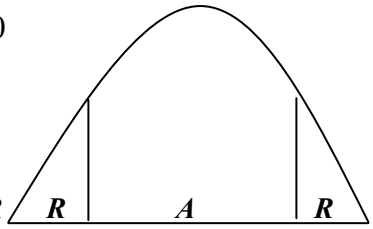
New Century Bank (μ_1) $n_1 = 200$ $\bar{x}_1 = 4.5$ $s_1 = 1.2$

Public Bank (μ_2) $n_2 = 300$ $\bar{x}_2 = 4.75$ $s_2 = 1.5$

SC: $\mu_1 = \mu_2$ $H_0: \mu_1 = \mu_2$ $H_0: \mu_1 - \mu_2 = 0$

OC: $\mu_1 \neq \mu_2$ $H_1: \mu_1 \neq \mu_2$ $H_1: \mu_1 - \mu_2 \neq 0$

Critical value (From Table) **Z** = ± 2.326



$$\textbf{TS} = z = \frac{(\bar{x}_1 - \bar{x}_2) - 0}{\sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}}} = \frac{(4.5 - 4.75) - 0}{\sqrt{\frac{1.2^2}{200} + \frac{1.5^2}{300}}} = \frac{-0.25}{.1212} = -2.06 \Rightarrow \textbf{\textit{Falls not inside CR}}$$

Conclusion: Accept Ho **Comment:** The claim of the management of the New Century Bank is true.

Paired Samples

Practice 15.

Before	8	5	4	9	6	9	5	
After	10	8	5	11	6	7	9	
d=A - B	**2**	**3**	**1**	**2**	**0**	**-2**	**4**	$\Sigma d = 10$ $\bar{d} = 1.429$ $s_d = 1.988$

$\mu_d =$ Average increase in self- confidence

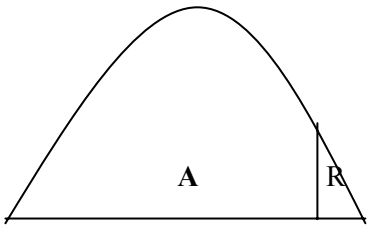
SC: After the course the self-confidence of company's employees increases.

CC.: After the course the self-confidence of company's employees **does not increase or remains** the **same**.

SC: $\mu_d > 0$ Ho: $\mu_d \leq 0$

OC: $\mu_d \leq 0$ $H_1: \mu_d > 0$

CV (From Table) $t = 1.943$



$$\textbf{TS} = t = \frac{\sqrt{n}(\bar{d} - \mu_d)}{s_d} = \frac{\sqrt{7}(1.429 - 0)}{1.988} = 1.90 \quad \Rightarrow \textbf{\textit{Falls not inside CR}}$$

Conclusion: Accept Ho

Comment: After the course the self-confidence of company's employees does not increase or remains the same.

Practice 16.

Before	180	195	177	221	208	199	
After	183	187	161	204	197	189	
d=A - B	**3**	**- 8**	**- 16**	**-17**	**- 11**	**- 10**	Σd = -59 $\bar{d} = -9.833$ $s_d = 7.19$

Average weight loss $= \mu_d$

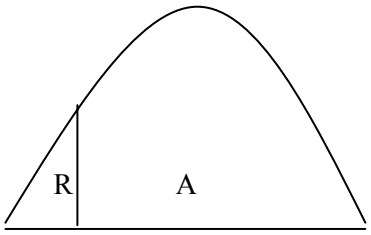
SC: This exercise program reduces the weight of participants?

OC: This exercise program does not reduce the weight of participants?

SC: $\mu_d < 0$ Ho: $\mu_d \geq 0$

OC: $\mu_d \geq 0$ H_1 : $\mu_d < 0$

CV (From Table) $t = -3.365$



TS $= t = \dfrac{\sqrt{n}(\bar{d} - \mu_d)}{s_d} = \dfrac{\sqrt{6}(-9.833 - 0)}{7.19} = -3.349$ $\Rightarrow$ ***Falls not inside CR***

Conclusion: Accept **Ho** **Comment:** This exercise program does not reduce the weight of participants?

Multinomial

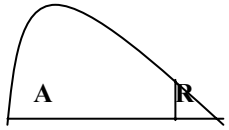
Practice 17. The following table lists the grade distribution for a sample of 80 students for stat class,

Grade	**A**	**B**	**C**	**D**	**F**	**Total**
O(**O**bserved)=Students	**16**	**17**	**18**	**15**	**14**	**80**
E(**E**xpected) =Students	**16**	**16**	**16**	**16**	**16**	**80**
$(O-E)^2$	$(16-16)^2$ **0**	$(17-16)^2$ **1**	$(18-16)^2$ **4**	$(15-16)^2$ **1**	$(14-16)^2$ **4**	
$(O-E)^2/E$	0/16 + 0	+ 1/16 + 0.0625	+ 4/16 + 0.25	+ 1/16 + 0.0625	+ 4/16 + 0.25 = **0.625**	$\chi^2 = \sum \dfrac{(O-E)^2}{E} = 0.625$

H_0: Proportions of students getting different grades are the same?

H_1: Proportions of students getting different grades are **not** the same?

K= 5, degrees of freedom $= 5 - 1 = 4$, **α = 5%** **CV** $= \chi^2 = 9.4877$



Test statistics $= \chi^2 = \sum \dfrac{(O-E)^2}{E} = 0.625$ $\Rightarrow$ ***Falls not inside CR***

Conclusion: Accept Ho **Comment*:*** Proportions of students getting different grades are the same.

Practice 18:

Modes of Transportation	**Drive alone**	**Car pool**	**Public**	**Transit**	**Other**	**Total**
O (**O**bserved)=Workers	812	102	57	29		**1000**

Test at α = 2.5% whether the current pattern of use of transportation modes is different than for 2003.

H_0: The current percentage distribution is the same as year 2003.

H_1: The current percentage distribution is different from year 2003.

Modes of Transportation	**Drive alone**		**Car pool**		**Public**		**Other**	**Total**
O (**O**bserved)=Workers	**812**		**102**		**57**		**29**	**1000**
E(**E**xpected)=Workers	.796(1000) **796**		.111(1000) **111**		051(1000) **51**		.042(1000) **42**	**1000**
$(O-E)^2$	(812-796)^2 **256**		(102-111)^2 **81**		(57-51)^2 **36**		(29-42)^2 **169**	
$(O-E)^2/E$	256/796 **0.322**	+	81/111 **0.730**	+	36/51 **0.706**	+	169/42 **4.24 = 5.782**	$\chi^2 = \sum \frac{(O-E)^2}{E}$ **= 5.782**

K= 4, degrees of freedom = 4-1 = 3, **α = .025** Critical value = χ^2 = **9.348** **Test statistic** = χ^2 = **5.782**

Conclusion: Accept **H_0**, Therefore the current percentage distribution is the same as year 2000.

Comment*:* Accepting that the current percentage distribution is the same as year 2003.