11 - P) p_1 = actual proportion of young people who use instant messaging more than email

p_2 = actual proportion of older people who use instant messaging more than email

A) 1. Both samples random

2. Sampling distributions normal

$n_1\hat{p}_1 = 73 > 10$ $\quad$ $n_2\hat{p}_2 = 26 > 10$

$n_1(1-\hat{p}_1) = 85 > 10$ $\quad$ $n_2(1-\hat{p}_2) = 117 > 10$

3. # young people in US > 10 (158) > 1580
older people in US > 10 (143) > 1430

I) $$90\%\,CI = (.462 - .182) \pm 1.645\sqrt{\frac{(.462)(.535)}{158} + \frac{(.182)(.818)}{143}}$$

2-Prop
Z Int

$$= (.20, .36)$$

★ S) I am 90% confident that between 20% and 36% more young people use instant messaging compared to older people

15 - P) p_1 = actual proportion of teens who own an iPod or MP3 player

p_2 = actual proportion of young adults who own an iPod or MP3 player

H) $H_0: p_1 = p_2$ or $H_0: p_1 - p_2 = 0$

$\boxed{H_a: p_1 \neq p_2}$ $H_a: p_1 - p_2 \neq 0$

17a - A) 1. Both samples were random

2. Normal sampling distributions

$n_1\hat{p}_1 = 632 > 10$ $n_2\hat{p}_2 = 268 > 10$

$n_1(1-\hat{p}_1) = 168 > 10$ $n_2(1-\hat{p}_2) = 132 > 10$

3. # US teens > 10 (800) > 8000

Young adults > 10 (400) > 4000

T) $\hat{p} = \dfrac{632 + 268}{800 + 400} = .75$ ✓

$$z = \frac{.79 - .67}{\sqrt{\frac{(.75)(.25)}{800} + \frac{(.75)(.25)}{400}}} = \underline{4.53}$$ 2-Prop Z Test

$p = .00006$

5) At $\alpha = .05$, there is significant evidence ($p = .000006$) to reject Ho and conclude the proportion of teens who own an iPod or MP3 player is different than the proportion of young adults who do

17b - P) See Above

A) See Above

I) $$95\%\ CI = (.79 - .67) \pm 1.96 \sqrt{\frac{(.79)(.21)}{800} + \frac{(.67)(.33)}{400}}$$

$$= (.07, .17)$$

5) I am 95% confident that between 7% and 17% more teens own an iPod or MP3 player compared to young adults. (This interval reinforces the alternative showing there is a difference.)

22a - P) p_1 = proportion of patients having a stroke after taking aspirin

p_2 = proportion of patients having a stroke after taking aspirin + dipyridamole

H) $H_0: p_1 = p_2$ or $H_0: p_1 - p_2 = 0$

$H_a: p_1 \neq p_2$ $\qquad$ $H_a: p_1 - p_2 \neq 0$

A) 1. Randomized experiment

2. Sampling distributions normal

$n_1\hat{p}_1 = 206 > 10$ $\qquad$ $n_2\hat{p}_2 = 157 > 10$

$n_1(1-\hat{p}_1) = 1443 > 10$ $\qquad$ $n_2(1-\hat{p}_2) = 1493 > 10$

3. Groups independent

T) $$\hat{p} = \frac{206 + 157}{1649 + 1650} = .11$$

$$z = \frac{.125 - .095}{\sqrt{\frac{(.11)(.89)}{1649} + \frac{(.11)(.89)}{1650}}} = \underline{2.75}$$

2-Prop Z Test

$p = .006$

5) At $\alpha = .05$ (or .01), there is significant evidence to reject Ho and conclude there is a difference in the proportions of patients who have a stroke depending on whether they take aspirin or aspirin + dipyridamole

22b - Type I Error : Concluding there is a difference between the 2 treatments when there is really no difference

Type II Error: Concluding there is no difference between the 2 treatments when, in fact, there is a difference

↓

More serious since a treatment to reduce strokes would not be used

27 - P) p_1 = actual proportion of 4-5 year olds who sort correctly

p_2 = actual proportion of 6-7 year olds who sort correctly

H) $H_0: p_1 = p_2$ or $H_0: p_1 - p_2 = 0$

$H_a: p_1 \neq p_2$ $\quad$ $H_a: p_1 - p_2 \neq 0$

A) 1. Randomly selected groups

2. Sampling distributions normal

$n_1 p_1 = 10 \geq 10$ ok $\quad$ $n_2 p_2 = 28 > 10$

$n_1(1-p_1) = 40 > 10$ $\quad$ $n_2(1-p_2) = 25 > 10$

3. # 4-5 year olds $> 10(50) > 500$

6-7 year olds $> 10(53) > 530$

T) From Minitab output:

$z = -3.45, \quad p = .001$

S) At $\alpha = .05$ (or .01) there is significant evidence to reject H_0 ($p = .001$) and conclude there <u>is</u> a difference in the sorting abilities between 4-5 year olds and 6-7 year olds

1997 AP EXAM

54%

A random sample of 415 potential voters was interviewed 3 weeks before the start of a state-wide campaign for governor. 223 of the 415 said they favored the new candidate over the incumbent. However, the new candidate made several unfortunate remarks one week before the election. Subsequently, a new random sample of 630 potential voters showed that 317 voters favored the new candidate.

50%

Do these data support the conclusion that there was a decrease in voter support for the new candidate after the unfortunate remarks were made? Give appropriate statistical evidence to support your answer.

P) p_1 = proportion of all voters supporting candidate 1st time

p_2 = proportion of all voters supporting candidate 2nd time

H) $H_0: p_1 = p_2 \quad (H_0: p_1 - p_2 = 0)$

$H_a: p_1 > p_2 \quad (H_a: p_1 - p_2 > 0)$

A) 1) Random - yes

2) Normal Samp Dist

$n_1\hat{p}_1 = 223 > 10$ ✓ $\quad n_2\hat{p}_2 = 317 > 10$ ✓

$n_1(1-\hat{p}_1) = 192 > 10$ ✓ $\quad n_2(1-\hat{p}_2) = 313 > 10$ ✓

3) $N_1 > 10(415) > 4150$ voters?

$N_2 > 10(630) > 6300$ voters?

T) 2 Prop Z Test:

$Z = 1.\underline{08}$, $p = .14$

S) At $\alpha = .05$, there is not enough evidence to reject H_0; there does not appear to have been a decrease in support after the candidate's unfortunate remarks

45 bc) Paying For College

P) μ_1 = average summer earnings of males
μ_2 = average summer earnings of females

A) 1. Random Samples Used

2. Sampling Distributions Normal
Both n_1 and $n_2 > 30$

3. Groups Independent
Males $> 10(675) > 6750$
Females $> 10(621) > 6210$

2-Samp T Int

I) $90\%\ CI = (1884.52 - 1360.39) \pm 1.660\sqrt{\frac{1368.37^2}{675} + \frac{1037.46^2}{621}}$

Row 100

$= (413.56,\ 634.70)$

S) I am 90% confident that, on average, male students earn between \$413.56 and \$634.70 more than female students during the summer

53 a) Who Talks More - Men or Women?

P) μ_M = mean number of words spoken by males

μ_F = mean number of words spoken by females

H) $H_0: \mu_M = \mu_F$ $(H_0: \mu_M - \mu_F = 0)$

$H_a: \mu_M \neq \mu_F$ $(H_a: \mu_M - \mu_F \neq 0)$

A) 1. Random Samples Used

2. Sampling Distribution Normal

n_M and $n_F > 30$

3. Groups Independent

Males > 10 (56) > 560

Females > 10 (56) > 560

T) $$t = \frac{16569 - 16177}{\sqrt{\frac{7520^2}{56} + \frac{9108^2}{56}}} = .248, \quad P = \underline{.8043}$$ 2-Sample T Test

S) At $\alpha = .05$, there is no evidence to reject Ho ($p = .8050$) and we conclude there is no difference in the average number of words spoken by males and females at this university

72a) Best to use Matched Pairs T Test

SAT Scores After Coaching − SAT Scores Before Coaching = 29 (Avg Gain)

b) P) μ = mean increase in SAT Verbal scores after being coached (after − before)

H) $H_0: \mu = 0$ $H_a: \mu > 0$

A) 1. Random Sample Used

2. Sampling Distribution Normal ($n > 30$)

3. # students coached > 10 (427) > 4270 ?

T) $$t = \frac{\bar{x}}{\frac{s}{\sqrt{n}}} = \frac{29}{\frac{59}{\sqrt{427}}} = 10.47$$

From Table, $P < .0005$

From Calculator, $P = 3.67 \times 10^{-22}$

T-Test

S) At $\alpha = .05$, there is overwhelming evidence that average SAT Verbal scores improved for students who were coached

72 c) How much better do students do on their SAT verbal score after being coached?

P) Same as before

A) Same as before

I) $$99\%\ CI = \bar{x} \pm t^* \frac{s}{\sqrt{n}}$$

$$= 29 \pm 2.626 \frac{59}{\sqrt{427}}$$

$$= (22, 36)$$

T Interval

S) I am 99% confident that, on average, students who were coached improved their SAT verbal scores between 22 and 36 points

73a) Do coached students improve more than uncoached students on Verbal SAT score?

P) μ_1 = average gain on SAT for coached students

μ_2 = average gain on SAT for uncoached students

H) $H_0: \mu_1 = \mu_2 \quad [H_0: \mu_1 - \mu_2 = 0]$

$H_a: \mu_1 > \mu_2 \quad [H_a: \mu_1 - \mu_2 > 0]$

A) 1. Both samples random

2. Sampling Distribution Normal

n_1 and $n_2 > 30$

3. Groups independent and

coached students > 10(427) > 4270 ?

uncoached students > 10(2723) > 27230 ?

T) $$t = \frac{\bar{x}_1 - \bar{x}_2}{\sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}}} = \frac{29-21}{\sqrt{\frac{59^2}{427} + \frac{52^2}{2733}}} = 2.646$$

From Table, Pvalue < .01

From Calculator, Pvalue = .004

2-Sample T Test

5) At $\alpha = .01$, there is good evidence ($p = .004$) to reject Ho and conclude that coached students improve their SAT Verbal scores more than uncoached students do

b) How much more do coached students improve compared to uncoached students?

P) Same as before

A) Same as before

I) $$\left.\begin{aligned} 99\%\ CI &= (\bar{x}_1 - \bar{x}_2) \pm t^* \sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}} \\ &= (29-21) \pm 2.587 \sqrt{\frac{59^2}{427} + \frac{52^2}{2733}} \end{aligned}\right\} \text{2-Samp T Int}$$

$$= (.178,\ 15.82)$$

5) I am 99% confident that, on average, coached students did between 0 and 16 points better on the SAT Verbal test compared to noncoached students

c) Are coaching courses worth paying for?

your decision ... 1 question $\approx$ 10 SAT points

WORKSHEET

(Sec 10.2)

Mark's cat "Sirius" is a finicky eater. Mark is trying to determine which of two brands of canned food Sirius prefers, Tab-a-Cat or Chow Lion. For two months, he flips a coin each day to decide which of the two brands to feed Sirius and weighs how much Sirius eats in grams. Here are the data:

	n	$\bar{x}$	s
Tab-a-Cat	31	85.2	3.45
Chow Lion	30	82.1	4.62

1. Perform a ~~significance~~ test (at $\alpha = .01$) to determine if the mean amount of Tab-a-Cat that Sirius eats is higher than the mean amount of Chow Lion he eats.

P) μ_1 = mean amount of Tab-a-Cat eaten by Sirius (gms)
μ_2 = mean amount of Chow Lion eaten by Sirius (gms)

H) $H_0: \mu_1 = \mu_2$ or $H_0: \mu_1 - \mu_2 = 0$
$H_a: \mu_1 > \mu_2$ $H_a: \mu_1 - \mu_2 > 0$

A) Random Samples Used; Sampling Distribution Normal ($n \geq 30$); Eating choices independent

T) $$t = \frac{\bar{x}_1 - x_2}{\sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}}} = \frac{85.2 - 82.1}{\sqrt{\frac{3.45^2}{31} + \frac{4.62^2}{30}}} = \underline{2.96}$$

From Table, P-value $< .005$
From Calculator, P-value $\approx .002$

S) At $\alpha = .01$, there is evidence to reject Ho ($p = .002$) and conclude that, on average, Sirius eats more Tab-a-Cat than Chow Lion indicating he prefers Tab-a-Cat

2. On the back, construct and interpret a 98% confidence interval for the difference in mean amount of food Sirius eats when he is offered Tab-a-Cat versus Chow Lion.

P) Same as before

A) Same as before

I) $98\%\ CI = (\bar{x}_1 - x_2) \pm t^* \sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}}$

$= (85.2 - 82.1) \pm \boxed{2.462} \sqrt{\frac{3.45^2}{31} + \frac{4.62^2}{30}}$

$= (.59, 5.61)$

S) I am 99% confident that, on average, Sirius eats between .59 and 5.61 more grams of Tab-a-Cat compared to Chow Lion