SECTION 11.2A HOMEWORK

INSTRUCTIONS: ATTACH WORK

35 Cholesterol (6.2) The level of cholesterol in the blood for all men aged 20 to 34 follows a Normal distribution with mean 188 milligrams per deciliter (mg/dl) and standard deviation 41 mg/dl. For 14-year-old boys, blood cholesterol levels follow a Normal distribution with mean 170 mg/dl and standard deviation 30 mg/dl.

(a) Let M = the cholesterol level of a randomly selected 20- to 34-year-old man and B = the cholesterol level of a randomly selected 14-year-old boy. Describe the shape, center, and spread of the distribution of $M - B$. SKETCH GRAPH.

(b) Find the probability that a randomly selected 14-year-old boy has higher cholesterol than a randomly selected man aged 20 to 34. Show your work.

37 Cholesterol Refer to Exercise 35. Suppose we select independent SRSs of 25 men aged 20 to 34 and 36 boys aged 14 and calculate the sample mean heights $\bar{x}_M$ and $\bar{x}_B$.

(a) Describe the shape, center, and spread of the sampling distribution of $\bar{x}_M - \bar{x}_B$.

(b) Find the probability of getting a difference in sample means $\bar{x}_M - \bar{x}_B$ that's less than 0 mg/dl. Show your work.

(c) Should we be surprised if the sample mean cholesterol level for the 14-year-old boys exceeds the sample mean cholesterol level for the men? Explain.

In Exercises 39–41, determine whether or not the conditions for using two-sample t procedures are met.

39 Shoes How many pairs of shoes do teenagers have? To find out, a group of AP Statistics students conducted a survey. They selected a random sample of 20 female students and a separate random sample of 20 male students from their school. Then they recorded the number of pairs of shoes that each respondent reported having. The back-to-back stemplot below displays the data.

Females		Males
	0	4
	0	555677778
333	1	0000124
95	1	
4332	2	2
66	2	
410	3	
8	3	58
	4	
9	4	
100	5	
7	5	

Key: 2|2 represents a male student with 22 pairs of shoes.

41 Literacy rates Do males have higher average literacy rates than females in Islamic countries? The table below shows the percent of men and women at least 15 years old who were literate in 2008 in the major Islamic nations. (We omitted countries with populations of less than 3 million.) Data for a few nations, such as Afghanistan and Iraq, were not available.[30]

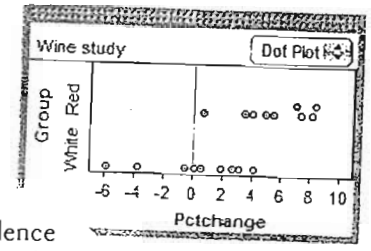
Country	Female percent	Male percent
Algeria	66	94
Bangladesh	48	71
Egypt	58	88
Iran	77	97
Jordan	87	99
Kazakhstan	100	100
Lebanon	86	98
Libya	78	100
Malaysia	90	98
Morocco	43	84
Saudi Arabia	79	98
Syria	77	95
Tajikistan	100	100
Tunisia	69	97
Turkey	81	99
Uzbekistan	96	99
Yemen	41	93

43 Is red wine better than white wine? Observational studies suggest that moderate use of alcohol by adults reduces heart attacks and that red wine may have special benefits. One reason may be that red wine contains polyphenols, substances that do good things to cholesterol in the blood and so may reduce the risk of heart attacks. In an experiment, healthy men were assigned at random to drink half a bottle of either red or white wine each day for two weeks. The level of polyphenols in their blood was measured before and after the two-week period. Here are the percent changes in level for the subjects in both groups:[31]

Red wine:	3.5	8.1	7.4	4.0	0.7	4.9	8.4	7.0	5.5
White wine:	3.1	0.5	−3.8	4.1	−0.6	2.7	1.9	−5.9	0.1

(a) A Fathom dotplot of the data is shown below. Use the graph to answer these questions:

- Are the centers of the two groups similar or different? Explain.
- Are the spreads of the two groups similar or different? Explain.



(b) Construct and interpret a 90% confidence interval for the difference in mean percent change in polyphenol levels for the red wine and white wine treatments.

(c) Does the interval in part (b) suggest that red wine is more effective than white wine? Explain.

45 Paying for college College financial aid offices expect students to use summer earnings to help pay for college. But how large are these earnings? One large university studied this question by asking a random sample of 1296 students who had summer jobs how much they earned. The financial aid office separated the responses into two groups based on gender. Here are the data in summary form:[33]

Group	n	$\bar{x}$	s_x
Males	675	$1884.52	$1368.37
Females	621	$1360.39	$1037.46

(a) How can you tell from the summary statistics that the distribution of earnings in each group is strongly skewed to the right? A graph of the data reveals no outliers. The use of two-sample t procedures is still justified. Why?

(b) Construct and interpret a 90% confidence interval for the difference between the mean summer earnings of male and female students at this university.

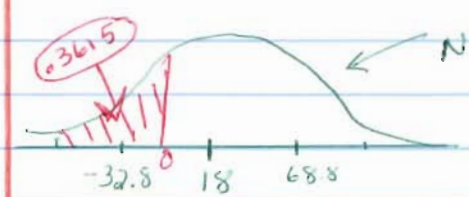
(c) Interpret the 90% confidence level in the context of this study.

11.2A HW

35A M = 20–34 MEN — $N(188, 41)$
B = 14 YR BOY — $N(170, 30)$

DISTRIBUTION of $M-B$

SHAPE: M and B are Normal, so $M-B$ is Normal
CENTER: $\mu_{M-B} = 188 - 170 =$ 18 mg/dl
SPREAD: $\sigma_{M-B} = \sqrt{\sigma_M^2 + \sigma_B^2} = \sqrt{41^2 + 30^2} =$ 50.80 mg/dl



35B $P(B > M) = P(0 > M-B) = P(M-B < 0) =$ .3615
normalcdf(-E99, 0, 18, 50.8)

Method 2 → find Z: $Z = \frac{0-18}{50.8} = -0.35$ $P(Z < -.35) =$ normalcdf(-E99, -.35, 0, 1) = .3632

37A DISTRIBUTION $\bar{X}_M - \bar{X}_B$ $n_M = 25$ $n_B = 36$

SHAPE: NORMAL CENTER: $\mu_{\bar{X}_M - \bar{X}_B} = M - B =$ 18 mg/dl
SPREAD: $\sigma_{\bar{X}_M - \bar{X}_B} = \sqrt{\frac{\sigma_M^2}{n_M} + \frac{\sigma_F^2}{n_F}} = \sqrt{\frac{41^2}{25} + \frac{30^2}{36}} =$ 9.60 mg/dl

37B $P(\bar{X}_M - \bar{X}_B < 0) =$ normalcdf(-E99, 0, 18, 9.6) = .0304
OR FIND $Z = \frac{0-18}{9.6} = -1.88$ $P(Z < -1.88) =$ .0301

37C IT SOMETIMES MAKES SENSE TO REWRITE $P(\bar{X}_M < \bar{X}_B) = .03$
* YES IT WOULD BE SURPRISING TO HAVE THE SAMPLE MEAN OF THE BOYS GREATER THAN THE MEN SINCE THE PROBABILITY IS ONLY 3%

39 THE NORMAL CONDITION IS NOT MET. ($N \leq 30$) THE GRAPH OF MALES SHOWS A SMALL SAMPLE ($n=20$) AND 2 OUTLIERS (35 + 38 pairs of shoes)

41 NO INDEPENDENT CONDITION NOT MET. More than 1 person from a household violates independence. This is an obscure question but interesting thought to keep in mind.

43

(a) THE CENTERS OF THE TWO GROUPS SEEM TO BE QUITE DIFFERENT, WITH PEOPLE DRINKING RED WINE GENERALLY HAVING MORE POLYPHENOL IN THEIR BLOOD

THE SPREAD, HOWEVER ARE APPROXIMATELY THE SAME.

(b) PARAMETERS

μ_R = actual mean change in polyphenol drinking red wine
μ_W = actual mean change in polyphenol drinking white wine

TEST: A 2 Sample t interval for $\mu_1 - \mu_2$
We want to estimate the difference $\mu_R - \mu_W$ at a 90% confidence level

CONDITIONS:

RANDOM: THIS WAS A RANDOMIZED EXPERIMENT

NORMAL: BOTH SAMPLE SIZES ARE LESS THAN 30, THE GIVEN DOTPLOT DOES NOT INDICATE AND OUTLIERS OR (NO) SERIOUS SKEWNESS.

INDEPENDENT:

① DUE TO RANDOM ASSIGNMENT, THESE 2 GROUPS OF MEN CAN BE VIEWED AS INDEPENDENT

② INDIVIDUALS CHANGE IN POLYPHENOL LEVEL GIVES NO INFORMATION ABOUT ANOTHER INDIVIDUAL.

σ UNKNOWN (t inference)

43 CONT

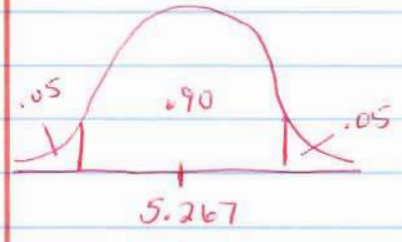
enter Red Wine in L1 and White Win in L2

2VAR STATS

Red Wine : $\bar{x} = 5.5$ $Sx = 2.5169$ $n = 9$

White Wine : $\bar{y} = .233$ $Sy = 3.292$ $n = 9$

90% CI: $(5.5 - .233) \pm t^* \cdot \sqrt{\frac{(2.517)^2}{9} + \frac{(3.292)}{9}}$



$5.267 \pm (1.860)(1.381)$

5.267 ± 2.569

(2.698, 7.836)

Conservative $df = 8$

$t^* = \text{INVT}(.05, 8) = 1.860$

Check w/ CALC (STAT) (TESTS) 0: 2-SAMP TINTERVAL

> DATA, L1, L2, 1, 1, .9, (NO) ← TECHNOLOGY TIP ALWAYS RECOMMEND "NO" TO POOLING

(2.845, 7.689) $df = 14.97$

$\bar{x}_1 = 5.5$ $\bar{x}_2 = .23$

$Sx_1 = 2.517$ $Sx_2 = 3.292$

$n_1 = 9$ $n_2 = 9$

CONCLUDE: We are 90% Confident that the interval 2.70 to 7.84 CAPTURES THE TRUE DIFFERENCE IN THE ACTUAL MEAN CHANGE IN POLYPHENOL LEVEL IN MEN WHO DRINK RED WINE AND MEN WHO DRINK WHITE WINE.

D SINCE THIS INTERVAL DOES NOT CONTAIN 0, IT DOES SUPPORT THE RESEARCHER'S BELIEF THAT THE CHANGE IN POLYPHENOL LEVEL IS DIFFERENT FOR MEN WHO DRINK RED WINE THAN THOSE WHO DRINK WHITE WINE.

10.2A
HW

4.5 **A** THE DISTRIBUTIONS ARE SKEWED TO THE RIGHT BECAUSE THE EARNINGS AMOUNTS CANNOT BE NEGATIVE, YET THE STANDARD DEVIATIONS ARE ALMOST AS LARGE AS THE DISTANCE BETWEEN THE MEANS AND ZERO. THE USE OF THE TWO-SAMPLE T PROCEDURE IS JUSTIFIED BECAUSE OF THE LARGE SAMPLE SIZES.

B

PARAMETERS: μ_M = actual mean summer earnings of male students

μ_F = actual mean earnings, female students

CONDITIONS: σ UNKNOWN (t inference)

Random - both samples were randomly selected

Normal - both samples are at least 30

Independent - reasonable there are more than 6,750 males and 6,210 females with summer jobs

TEST: 2 SAMPLE T INTERVAL FOR $\mu_1 - \mu_2$ 90%

$$\bar{x}_m - \bar{x}_F \pm t^* \sqrt{\frac{s_m^2}{n_m} + \frac{s_F^2}{n_f}}$$

$$1884.52 - 1360.39 \pm 1.647 \sqrt{\frac{1368.37^2}{675} + \frac{1037.46}{621}}$$

CALCULATOR
2-SampTINT
STATS
$\bar{x}_1 = 1884.52$
$Sx_1 = 1368.37$
$n_1 = 675$
$\bar{x}_2 = 1360.39$
$Sx_1 = 1037.46$
$n_2 = 621$
C-LEVEL = .90
POOLED = NO
(413.062, 634.64)
$\hat{df}$ = 1249.2

$t^* = \text{invT}(.05, 620) = 1.647$
$df_M = 674$
$df_F = 620$

$524.13 \pm 1.647(67.136)$
524.13 ± 110.572
(413.56, 634.64)

CONCLUDE: WE ARE 90% CONFIDENT THAT THE TRUE DIFFERENCE IN MEAN SUMMER EARNINGS OF MALE AND FEMALE STUDENTS IS BETWEEN 413.56 and 634.64.

10.2A HW

45 CONT

C IF WE REPEATEDLY TOOK RANDOM SAMPLES OF 675 males and 621 females from the same university and each time constructed a 90% confidence interval in this same way about 90% of the resulting intervals would capture the actual difference in mean summer earnings