Sample 2

Problem 2 (16 points)

A principal of a local high school uncovered interesting information in the archives regarding sex differences and science scores. In 1982, males did significantly better than females in science. The principal randomly selected current science grades of 10 males and 10 females to see if the differences still exist.

Males	**70**	**65**	**71**	**72**	**64**	**66**	**69**	**70**	**62**	**71**
Females	**95**	**92**	**90**	**89**	**85**	**80**	**91**	**85**	**84**	**89**

Do males perform better than females in science today?

Use SPSS to answer the question.

a. Follow the four steps for hypothesis testing. Use $\alpha = .05$. **(10 points)**

Hypotheses

Null hypothesis ($\mathbf{H_0}$): There is no statistically significant difference in science scores between genders.

Alternative hypothesis ($\mathbf{H_1}$): There is a statistically significant difference in science scores between genders.

Running the independent samples t-test generated the following test output:

Output

Independent samples test results

Group Statistics

	Gender	N	Mean	Std. Deviation	Std. Error Mean
Score	Male	10	68.00	3.46410	1.09545
	Female	10	88.00	4.44722	1.40633

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Score	Equal variances assumed	.488	.494	-11.22	18	.000	-20.00000	1.78263	-23.74517	-16.25483
	Equal variances not assumed			-11.22	16.98	.000	-20.00000	1.78263	-23.76132	-16.23868

The independent samples test comparing science scores revealed a statistically significance difference between genders, $t(18) = -11.22$, $p < .05$. Male students scored lower (M = 68, SD = 3.46) than female students (M = 88, SD = 1.41). The findings imply there is sufficient evidence to reject the null hypothesis. Female students score better than male students.

b. Compute the effect size using r^2. (2 points)

$$r^2 = \frac{t^2}{t^2+df} = \frac{-11.219^2}{-11.219^2+18} = \frac{125.87}{143.86} = 0.87$$

$r^2 = 0.87$

The effect size of 0.87 suggests that gender has a significant effect. The mean scores differ significantly between male and female students.

c. Calculate the point estimate for $\mu_1 - \mu_2$. (2 points)

The point estimate is 68 – 88 = -20

d. Calculate the 99% confidence interval for $\mu_1 - \mu_2$. (2 points)

Running independent sample t-test using α at .01 generates the following output:

Output

Independent samples test result at 99% confidence level

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									99% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Score	Equal variances assumed	.488	.494	-11.22	18	.000	-20.00000	1.78263	-25.13	-14.87
	Equal variances not assumed			-11.22	16.98	.000	-20.00000	1.78263	-25.17	-14.83

At 99% confidence level, the interval for $\mu_1 - \mu_2$ is between -25.13 and -14.87. On average, female students' performed better than male students by between 14.87 and 25.13 marks.