Chapter 11

2. Defining characteristic of a repeated measure is that one group of individuals must participate in all the different treatment conditions.

4. $df = 15$

Independent measures $df = n_1 + n_2 - 2$ and $n_1 = n_2$

$15 = 2n_1 - 2$

$2n_1 = 17$

Repeated measures

$df = n - 1 = 15$

$n = 16$

6.

Repeated measures $t = \frac{M_D - \mu_D}{S_{M_D}}$ ~~Numerator~~ is the actual difference between the sample mean of difference scores and the hypothesized population mean of difference scores

Single Sample statistic - actual difference between the sample mean and the hypothesised population mean

8. $N = 9$

	X_1	X_2	D	D^2
A	82	89	+7	49
B	64	67	+3	9
C	76	79	+3	9
D	6	8	+2	4
E	38	40	+2	4
F	150	147	-3	9
G	10	14	4	16
H	4	11	7	49
I	16	18	2	4
			$\Sigma D = 27$	$\Sigma D^2 = 153$

a) difference scores

$\Sigma D = 27$

$M_D = \bar{D} = \frac{\Sigma D}{n} = \frac{27}{9} = 3$

b) $SS = \Sigma D^2 - (\Sigma D)^2/N$

$= 153 - 27^2/9 = 72$

$s^2 = \frac{SS}{n-1} = \frac{72}{8} = 9$

$SE = \frac{s}{\sqrt{n}} = \frac{3}{\sqrt{9}} = 1$

c) $t_{8,0.05} = \pm 2.306$

$t_{stat} = \frac{M_D - \mu_D}{S_{M_D}} = \frac{3-0}{1} = 3$

10. $n = 20$

$M_D = 4.8$

$S^2 = 125 \qquad S = \sqrt{125} = 11.18$

$S_{M_D} = \sqrt{\frac{S^2}{n}} = \sqrt{\frac{125}{20}} = 2.5$

$t = \frac{M_D - \mu_D}{S_{M_D}} = \frac{4.8 - 0}{2.5} = 1.92$

$t_{19,0.05} = 1.729$

Yes the result confirms that

b) Confidence level 80%

$\alpha = 0.2$, $t_{19,0.2} = 0.86095 \approx 0.8610$

$M_D \pm t(S_{M_D})$

$4.8 \pm 0.8610(2.5) = 4.8 \pm 2.1525 = (2.6475, 6.9525)$

c) The null hypothesis gets rejected at $\alpha = 0.05$ and gets rejected at $\alpha = 20\%$ and has a confidence interval $(2.6475, 6.9525)$

12. $n = 9$

$M_D = 7$

$SS = 288$

$$s^2 = \frac{SS}{n-1} = \frac{288}{8} = 36$$

$$S_{M_D} = \sqrt{\frac{s^2}{n}} = \sqrt{\frac{36}{9}} = 2$$

$$t = \frac{M_D - \mu_D}{S_{M_D}} = \frac{7-0}{2} = 3.5$$

$$t_{8,\,0.05} = \pm 2.3060$$

The null hypothesis gets rejected and thus there is a difference between the stores

b) $\mu_D = M_D \pm t \cdot S_{M_D}$
$= 7 \pm 3.5 \cdot 2 = 7 \pm 7 = (0, 14)$

c) We rejected the null hypothesis and concluded that there is a difference btw the stores. The population mean difference is between 0 and 14.

14. a) $n = 8$, $M_D = 3$, $S^2 = 72$, $\alpha = 0.05$

$$S_{M_D} = \sqrt{\frac{\cancel{S_{SSD}}\,S^2}{n}} = \sqrt{\frac{72}{8}} = 3$$

$$t = \frac{M_D - \mu_D}{S_{M_D}} = \frac{3-0}{3} = 1$$

$$t_{n-1,\,\alpha} = t_{7,\,0.05} = 1.8946$$

The null hypothesis is not rejected and therefore $\mu_D = 0$

(b) $M_D = 9$

$S_{M_D} = 3$ $\quad t = \frac{9-0}{3} = 3$

$t_{7, 0.05} = 1.8946$

The null hypothesis is rejected and therefore the sample did not come from a population with a mean of 0 ($\mu_D = 0$)

c) It reduces the chance of getting significant mean difference when increased

16. Problems : Can lead to false conclusions that the different conditions caused results when it was really just individual differences between participants

Decreased by matching participants on a variable that is unrelated to the dependent variables

18 $n = 15$, $M_D = 1.40$, $s = 2.59$

$$S_{M_D} = \sqrt{\frac{s^2}{n}} = \sqrt{\frac{2.59^2}{15}} = 0.6687$$

$$t = \frac{M_D - \mu_D}{S_{M_D}} = \frac{1.40 - 0}{0.6687} = 2.0936$$

$t_{14, 0.05} = 1.7613$

The null hypothesis tests false / is rejected.

b) $$r^2 = \frac{t^2}{t^2 + df} = \frac{2.0936^2}{2.0936^2 + 14} = 0.2384$$

c) The null hypothesis is rejected and therefore we conclude that the treatment significantly affects cognitive performance. Effect size is small or trivial

20. $n = 7$

	X_1	X_2	X_1-M	$(X_1-M)^2$	X_2-M_2	$(X_2-M_2)^2$	D
A	32	8	-18	324	-33	1089	-24
B	66	68	16	256	27	729	2
C	52	48	2	4	-7	49	-4
D	48	37	-2	4	-4	16	-11
E	52	44	2	4	3	9	-8
F	48	38	-2	4	-3	9	-10
G	52	44	2	4	3	9	-8
	$\Sigma = 350$	$\Sigma = 287$		$\Sigma = 600$		$\Sigma = 1910$	$\Sigma D = -63$

$M_1 = \frac{350}{7} = 50$ $\qquad M_2 = \frac{287}{7} = 41$

$S_1^2 = \frac{600}{7} = 85.714$

$S_2^2 = \frac{1910}{7} = 272.86$

$Sp^2 = \frac{(n-1)S_1^2 + (n-1)S_2^2}{n_1+n_2-2} = \frac{6(85.714) + 272.86(6)}{12} = 179.287$

$SE = \sqrt{\frac{Sp^2}{n_1} + \frac{Sp^2}{n_1}} = \sqrt{\frac{179.287}{7} + \frac{179.287}{7}} = 7.157$

$m_1 - m_2 / SE$

$t = \frac{\cancel{M_D - \mu_D}}{\cancel{S_{MD}}} = \frac{272.86 - 85.714}{7.157}$ $\qquad \Sigma D = -63$

$M_D = \frac{\Sigma D}{n} = -\frac{63}{7} = -9$

$t = 26.14$

$\cancel{S_{MD} = \Sigma D^2 - (\Sigma D)^2 / N}$

$\cancel{= 945 - (63)^2/7 = 378}$

$t = \frac{-9-0}{378} = -0.0238$

$t_{6,\,0.05} = \pm 2.4469$

The null hypothesis is not rejected, therefore there is a significant difference between the two sets of scores.

(b) $n = 7$

Variance From the table in (a)

$SS = \Sigma D^2 - (\Sigma D)^2/N = 945 - 63^2/7 = 378$

$S^2 = \frac{SS}{n-1} = \frac{378}{6} = 63 \Rightarrow s = \sqrt{63} = 7.9372$

$SE = \frac{s}{\sqrt{n}} = \frac{7.9372}{\sqrt{7}} = 3$

$t = \frac{M_D - \mu_D}{S_{M_D}} = \frac{-9-0}{3} = -3$

$t_{6, 0.05} = \pm 2.4469$

22.

$n = 7$	X_1	X_2	$(X_1 - m_1)$	$(X_1 - m_1)^2$	$(X_2 - m_2)$	$(X_2 - m_2)^2$	(D) $X_2 - X_1$	D^2
A	32	37	-18	324	-4.29	18.4041	5	25
B	66	68	16	256	26.71	713.4241	2	4
C	52	46	2	4	4.71	22.184	-6	36
D	48	8	-2	4	-33.29	1108.22	-40	1600
E	52	44	2	4	2.71	7.344	-8	64
F	48	48	-2	4	6.71	45.02	0	0
G	52	38	2	4	-3.29	10.82	-14	196
							$\Sigma D = -61$	$\Sigma = 1925$

$\bar{X}_1 = \frac{1}{7}(32+66+52+48+52+48+52) = 50$

$\bar{X}_2 = \frac{1}{7}(37+68+46+8+44+48+38) = 41.29$

$S_1^2 = \frac{\Sigma (X_1 - m_1)^2}{n} = \frac{600}{7} = 85.71$

$S_2^2 = \frac{1925.384}{7} = 275.05$

$Sp^2 = \frac{(n-1)S^2 + (n-1)S^2}{n_1 + n_2 - 2} = \frac{6 \times 85.71 + 6 \times 275.05}{12} = 180.38$

$SE = \sqrt{\frac{Sp^2}{n_1} + \frac{Sp^2}{n_2}} = \sqrt{\frac{180.38}{7} + \frac{180.38}{7}} = 7.179$

$t = \frac{m_1 - m_2}{SE} = \frac{50 - 41.29}{7.179} = 1.2133$

$t_{6, 0.05} = 2.4469$

There is no significant difference

b) $n = 7$

$SS = \Sigma D^2 - (\Sigma D)^2/n$

$SS = 1925 - 61^2/7 = 1393.44$

$S^2 = \frac{SS}{n-1} = \frac{1393.44}{6} = 232.24$

$SE = \frac{S}{\sqrt{n}} = \sqrt{\frac{S^2}{n}} = \sqrt{\frac{232.24}{7}} = 5.7599$

$t = \frac{M_D - \mu_D}{S_{M_D}} = \frac{-\frac{61}{7} - 0}{5.7599} = -1.5129$

$t_{6, 0.05} = \pm 2.4469$

The null hypothesis not rejected

24. a) $n = 20$

$n_1 + n_2 = 20 + 20 + 2 = 42.$

b) $n + 1 = 20 + 1 = 21$

c) $n = 42$

26.