Solution 1

$H_0 : p_1 - p_2 = 0$
$H_a : p1 - p_2 > 0$
T.S.

$$\hat{p} = \frac{x_1 + x_2}{n_1 + n_2} = \frac{1370 \times 29\% + 1370 \times 18\%}{1370 \times 2} = \frac{643.9}{1370 \times 2} = 23.5\%$$

$$Z = \frac{\hat{p_1} - \hat{p_2}}{\sqrt{\hat{p}(1 - \hat{p})(\frac{1}{n_1} + \frac{1}{n_2})}}$$

$$= \frac{0.29 - 0.18}{\sqrt{0.235 \times 0.765 \times \frac{2}{1370}}}$$

$$\approx 6.8$$

R.R.   Reject H_0 if $z > z_{.05} = 1.645$.

Conclusion:

Since $z_{ob} >> 1.645$ we can reject H_0 at 5% level of significance and conclude that there has been a significant change in the percent of internet users who download music.

95% confidence interval for $p_1 - p_2$ is

$$\hat{p_1} - \hat{p_2} \pm z_{.05}\sqrt{\frac{\hat{p_1}(1 - \hat{p_1})}{n_1} + \frac{\hat{p_2}(1 - \hat{p_2})}{n_2}}$$

$$\Longrightarrow (0.29 - 0.18) \pm 1.96 \times \sqrt{\frac{0.29 \times 0.71}{1370} + \frac{0.18 \times 0.82}{1370}}$$

$$\Longrightarrow 0.11 \pm 0.03148$$

$$\Longrightarrow (0.078516, 0.14148)$$

Solution 2

2 weeks				118	120		126	126	129	
16 weeks	98	110	110			124				140
Rank	1	2.5	2.5	<u>4</u>	<u>5</u>	6	<u>7.5</u>	<u>7.5</u>	<u>9</u>	10

H_0 : Breaking strength have the same distribution.
H_a : Breaking strength are lowver for strips buried longer.
T.S.

$$W = 4 + 5 + 7.5 + 7.5 + 9 = 33$$

$$\mu_W = \frac{5 \times (10 + 1)}{2} = 27.5$$

$$\sigma_W^2 = \frac{5 \times 5 \times (10 + 1)}{12} = 22.917$$

$$\sigma_W = 4.787$$

R.R.   If $\dfrac{W - \mu_W}{\sigma_W} > 2$, reject H_0.

Conclusion:

Since $\dfrac{W - \mu_W}{\sigma_W} = \dfrac{33 - 27.5}{4.787} = 1.1489 < 2$, we cannot reject H_0.

Solution 3

| | Area transferred to | | | | |
Initial major	Engineering	Management	Liberal arts	Other	Total
Biology	13 (25.3)	25 (34.6)	158 (130.2)	202 (207.9)	398
Chemistry	16 (7.2)	15 (9.9)	19 (37.3)	64 (59.6)	114
Mathematics	3 (4.6)	11 (6.3)	20(23.6)	38 (37.6)	72
Physics	9 (3.9)	5 (5.3)	14 (20.0)	33 (31.9)	61
Total	41	56	211	337	645

H_0 : Initial major and transferred area are independent.
H_a : Initial major and transferred area are NOT independent.
T.S.

$$\chi^2 = \sum_i \sum_j \frac{(O_{ij} - E_{ij})^2}{E_{ij}}$$
$$= \frac{(13-25.3)^2}{25.3} + \frac{(25-34.6)^2}{34.6} + + \cdots + \frac{(33-31.9)^2}{31.9}$$
$$\approx 50.5$$
$$\nu = (4-1)(4-1) = 9$$

R.R.
Reject H_0 if $\chi^2 > \chi^2_{.05}(9) = 16.92$
Conclusion:
Since $\chi^2_{ob} > 16.92$, we can reject H_0 at 5% level of significance and conclude that there is dependence between initial major and transferred area.

Solution to 4

A	10	20	25	30	33	37	41	43	46	46					
r_A	1	2.5	4	6	7	9	11.5	13	14.5	14.5					
B		20	27	35	40	41					50	50	54	56	57
r_B		2.5	5	8	10	11.5					16.5	16.5	18	19	20

H_0 : Two teaching methods are the same.
H_a : Two teaching methods are not the same.
T.S.

$$W = 1 + 2.5 + 4 + 6 + 7 + 9 + 11.5 + 13 + 14.5 + 14.5 = 83$$
$$\mu_W = \frac{10(20+1)}{2} = 5 \times 21 = 105$$
$$\sigma_W^2 = \frac{10 \times 10 \times (20+1)}{12} = 175 \qquad \sigma_W = 13.23$$
$$Z = \frac{W - \mu_W}{\sigma_W} = \frac{83 - 105}{13.23} = -1.66$$
$$\text{P-value} = P(Z < -1.66) = 1 - 0.9515 = 0.0485$$

Conclusion:
Since p-value is less than 5%, we can reject H_0 at 5% level of significance.

Solution to 5

|d|	1	1	2	2	2	3	3	3	3	3	3	6	6	6	6	6	(6)
R	1.5	1.5	4	4	4	8.5	8.5	8.5	8.5	8.5	8.5	14.5	14.5	14.5	14.5	14.5	14.5

$W^+ = 138.5$