Assignment - 2

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1) H_0: There is no difference between the average heights of American & English men

$\overline{x_1} = \overline{x_2}$

H_1: Americans are taller than english men

$\overline{x_1} \otimes \overline{x_2}$

right > tail test

Americans   English

$\overline{x_1} = 172$ $\overline{x_2} = 170$

$S_1 = 6.3$ $S_2 = 6.4$

$m_1 = 1600$ $m_2 = 6400$

$$S = \frac{m_1 S_1^2 + m_2 S_2^2}{m_1 + m_2 - 2} = \frac{1600(6.3)^2 + 6400(6.4)^2}{1600 + 6400 - 2}$$

$$S^2 = \frac{325648}{7998} = 40.716$$

$$S = 6.38$$

$$t = \frac{\bar{x}_1 - \bar{x}_2}{8 \sqrt{\frac{1}{m_1} + \frac{1}{m_2}}} = \frac{172 - 170}{6.38 \sqrt{\frac{1}{600} + \frac{1}{6400}}} , \quad t = 11.215$$

$df = 7998 \quad \alpha = 5$

$F_T = 1.645 \implies |t| > F_T$

$\implies \therefore H_0$ rejected $\implies H_1$ accepted

A mexican are taller than English men

2) $m = 500 \qquad x = 65$

$$P = \frac{65}{500} = 0.13 \implies q = 1 - p = 0.87$$

$$SE(P) = \sqrt{\frac{pq}{m}} = 0.01503$$

Probable limits $\quad z_\alpha = 3$

$$P \pm 3 [SE(P)] = 0.13 \pm 3(0.0150)$$

$$= 0.13 - 3(0.015) \text{ to } 0.13 + 3(0.015)$$
$$= 0.085 \leq P \leq 0.175$$
$$= 8.5\% \text{ to } 17.5\%$$

3) H_0 — The considered is mean (100) is from population $\quad \mu = 100$

$\bar{x} = 100$

H_1 — $\bar{x} \neq 100 \Rightarrow \bar{x} \neq \mu$

$\bar{x} = 97.2$

x_i	70	120	110	101	88	83	95	98	107	100
$\lvert x_i - \bar{x} \rvert$	27.2	22.8	12.8	3.8	9.2	14.2	2.2	0.8	9.8	2.8
$(x_i - \bar{x})^2$	739.84	519.84	163.84	14.44	84.64	201.64	4.84	0.64	96	7.84

$$ S^2 = \frac{\sum (x_i - \bar{x})^2}{n-1} = \frac{1833.6}{10-1} = 203.66 $$

$$ S = 14.2709 \qquad df = n - 1 = 9 $$

$$ t = \frac{\bar{x} - \mu}{S/\sqrt{n}} = \frac{97.2 - 100}{14.2/\sqrt{10}} = -0.6204 $$

$$ F_t \,(df = 9 \quad \alpha = 5 \quad \text{two tail}) = 2.262 $$

$$ \lvert t \rvert < F_T \Rightarrow H_0 \text{ accepted} $$

mean can be assumed to be 100

$$|t| \leq \ast F_T$$

$$-2.262 \leq t \leq 2.262$$

$$-2.262 \leq \frac{97.2 - \mu}{\frac{14.27}{\sqrt{10}}} \leq 2.262$$

$$\Rightarrow \boxed{86.99} \leq \mu \leq 107.407$$

4) H_0 - There is no significant difference b/w 2 sample $$\overline{x_1} = \overline{x_2}$$

H_1 - There is significant difference b/w 2 sample $$\overline{x_1} \neq \overline{x_2}$$

x_1	$\lvert x_1 - \bar{x}\rvert$	$(x_1 - \bar{x_1})^2$		x_2	$\lvert x_2 - \bar{x_2}\rvert$	$(x_2 - \bar{x_2})^2$
25	3	9		44	14	196
32	4	16		34	4	16
30	2	4		22	8	64
34	6	36		10	20	400
24	4	16		47	17	289
15	13	169		31	1	1
32	4	16		40	10	100
24	4	16		30	0	0
30	2	4		32	2	4
31	3	9		35	5	25
35	7	49		18	12	144
25	3	9		21	9	81
				35	5	25
				29	1	1
				22	8	64
336				450		

$$\bar{x_1} = 28 \qquad \bar{x_2} = 30$$

$$S^2 = \frac{\sum (x_i - \bar{x_1})^2 + \sum (x_i - \bar{x_2})^2}{m_1 + m_2 - 2} = 71.6$$

$$t = \frac{\bar{x_1} - \bar{x_2}}{S\sqrt{\frac{1}{m_1} + \frac{1}{m_2}}} = \frac{28 - 30}{71.6\sqrt{\frac{1}{12} + \frac{1}{15}}} = -0.61$$

$$F_T(df = 25, \alpha = 5) = 2.060$$

$$|t| < F_T \Rightarrow H_0 \text{ accepted}$$

$\Rightarrow$ There is no significant difference b/w data

§ H_0 – There is no significant difference b/w sample
$\sigma_1^2 = \sigma_2^2$

H_1 – There is significant difference b/w samples
$\sigma_1^2 \neq \sigma_2^2$

x	9	11	13	11	15	9	12	14	
y	10	12	10	14	9	8	10		
$|x_i - \bar{x}|$	2.75	0.75	+1.25	0.75	+3.25	2.75	0.25	2.25	
$|y_i - \bar{y}|$	0.43	1.57	0.43	3.57	1.43	2.43	0.43		
$(x_i - \bar{x})^2$	7.565	0.5625	1.5625	0.5625	10.5625	7.5625	0.0625	5.0625	
$(y_i - \bar{y})^2$	0.1849	2.4649	0.1849	12.7449	2.0449	5.9049	0.1849	5.00	

$$\bar{x} = 11.785 \qquad \bar{y} = 10.43$$

$$s_1^2 = \frac{\sum (x_1 - \bar{x})^2}{n_1} = \frac{33.5}{8} = 4.19$$

$$s_2^2 = \frac{\sum (x_2 - \bar{x})^2}{n_2} = \frac{23.71}{7} = 3.38$$

$$\sigma_1^2 = \frac{n_1 s_1^2}{n_1 - 1} = 4.79 \qquad \sigma_2^2 = \frac{n_2 s_2^2}{n_2 - 1} = 3.943$$

$$F = \frac{\sigma_1^2}{\sigma_2^2} = \frac{4.79}{3.943} = 1.2148$$

$$F_T \ (\vartheta_1 = 7, \vartheta_2 = 6, d = 5) = 4.21$$

$$|F| < F_T^{\varepsilon} \implies H_0 \text{ accepted}$$

There is no significant difference b/w the Samples

6) H_0 : Data is consistent $(\bar{x} = \mu)$

H_1 : Data is inconsistent $\bar{x} \neq \mu$

Exp. freq. $= 9 : 3 : 3 : 1 \implies$ ⊛

$N = 1600$

exp freq $\implies A = \frac{9}{16} \times 1600 = 900$

$$B = \frac{3}{16} \times 1600 = 300$$

$$C = \frac{3}{16} \times 1600 = 300$$

$$D = \frac{1}{16} \times 1600 = 100$$

O_i	882	313	287	118	
E_i	900	300	300	100	
$\lvert O_i - E_i \rvert$	18	13	13	18	
$\dfrac{(O_i - E_i)^2}{E_i}$	0.36	0.5633	0.5633	3.24	

$$\chi^2 = \frac{\Sigma (O_i - E_i)^2}{E_i} = 4.7266$$

$$\chi^2_T = (df = 2, \ \alpha = 5) = 7.815$$

$$\chi^2 < \chi^2_T \Rightarrow H_0 \text{ accepted}$$

$$\text{Data is consistent}$$

7) BD fits | H_0: BD is a good fit
H_1: BD is not a good fit

x	0	1	2	3	4	5	6	Total
f	5	18	28	12	7	6	4	80
xf	0	18	56	36	28	30	24	192

$$\text{Mean} = \frac{\Sigma fx}{\Sigma f} = \frac{192}{80} = 2.4 = mp$$

$$n = 6 \Rightarrow p = \frac{2.4}{6} = 0.4$$

$q = 1 - p = 0.6$

$P(x) = {}_mC_x \, p^x \, q^{m-x}$

$P(0) = {}_6C_0 \, p^0 \, q^6 = 0.047 \Rightarrow NP(0) = 3.76$

$P(1) = {}_6C_1 \, p^1 \, q^{6-1} = 0.187 \Rightarrow NP(1) = 14.96$

$P(2) = {}_6C_2 \, p^2 \, q^4 = 0.311 \Rightarrow NP(2) = 24.88$

$P(3) = {}_6C_3 \, p^3 \, q^3 = 0.276 \Rightarrow NP(3) = 22.8$

$P(4) = {}_6C_4 \, p^4 \, q^2 = \cancel{0.276} \\ 0.138 \Rightarrow NP(4) = 11.04$

$P(5) = {}_6C_5 \, p^5 \, q^1 = \cancel{0.138} \\ 0.037 \Rightarrow NP(5) = 2.96$

$P(6) = {}_6C_6 \, p^6 \, q^0 = 0.004 \Rightarrow NP(6) = 0.032$

Binomial distribution

x	0	1	2	3	4	5	6
$P(x)$	0.047	0.187	0.311	0.276	0.138	0.037	0.004
$NP(x)$	3.76	14.96	24.88	22.8	11.04	2.96	0.032
Approx	4	15	25	23	11	3	0

Grouping $x = 0, 5, 6$

$df = m - 1$
$= 4$

O_i	15	18	28	12	7
E_i	7	15	25	22	11
$\lvert O_i - E_i \rvert$	8	3	3	10	4
$\dfrac{(O_i - E_i)^2}{E_i}$	9.14	0.6	0.36	4.55	1.45

$$\chi^2 = 9.14 + 0.6 + 0.36 + 4.55 + 1.45 = 16.1$$

$$\chi^2_T = 9.488 \qquad \chi^2 > \alpha \, \chi^2_T \Rightarrow Rej. \ H_0$$

H_1 accepted

Hence bd is not a good fit

8) H_0 - There is no. significant diff b/w researcher

H_1 - There is significant of diff b/w researches

Research					Total	
X	86	60	44	10	200	
Y	40	33	25	2	100	
Total	126	93	69	12	300	

Exp Freq						
X	84	62	46	8		
Y	42	31	23	4		
	126	93	69	12		

θ_i	86	60	44	10	40	33	25	2	
E_i	84	62	46	8	42	31	23	4	
$[\theta_i - E_i]$	2	2	2	2	2	2	2	2	
$\dfrac{(\theta_i - E_i)^2}{E_i}$	0.0476	0.0645	0.0869	0.5	0.0952	0.129	0.1739	1	

$$\chi^2 = \frac{\Sigma (\theta_i - E_i)^2}{E_i} = 2.0971$$

$$\chi_T^2 = 200 \ 7.815 \quad (df = (n-1)(c-1) = 3)$$

$$\alpha = 5\%$$

$|\chi_c^2| < \chi_T^2$

$\Rightarrow H_0$ accepted

There is no

Significant diff b/w

research