NAME:

1. A study found that mongolism in babies is associated with hepatitis A injection of the mother during pregnancy. Suppose a study of 2000 randomly selected mothers to be yielded the following table after the births of their babies.

Hepatitis A.	Baby		
	Mongoloid	Non-Mongoloid	Total
+	26	34	60
-	4	1936	1940
Total	30	1970	2000

Perform a chi square test for independence with $\alpha = 0.05$

Solution

$\Rightarrow$ setting up the 2 hypothesis

$\Rightarrow H_0 -$ There is no association between mongolism in babies and hepatitis A injection of mothers during pregnancy

$\Rightarrow H_a -$ There is association between mongolism in babies and hepatitis A injection of mothers during pregnancy

Hepatitis	Baby		
A	Mongoloid	Non-Mongoloid	Total
+	26, EX1=0.9	34, EX2=59.1	60
-	4, EX3=29.1	1936, EX4=1910.9	1940
Total	30	1970	2000

$$\Rightarrow EX- > \text{Expected frequency}$$

$$\Rightarrow EX_1 = \frac{30 \times 60}{2000} = 0.9$$

$$\Rightarrow EX_2 = \frac{1970 \times 60}{2000} = 59.1$$

$$\Rightarrow EX_3 = \frac{30 \times 1940}{2000} = 29.1$$

$$\Rightarrow EX_4 = \frac{1970 \times 1940}{2000} = 1910.9$$

$$\Rightarrow X^2_{cal} = \sum \frac{(O-E)^2}{E}$$

$$\Rightarrow \frac{(26-0.9)^2}{0.9} + \frac{(34-59.1)^2}{59.1} + \frac{(4-29.1)^2}{29.1} + \frac{(1936-1910.9)^2}{1910.9}$$

$$\Rightarrow 700.1 + 10.66 + 21.65 + 0.33 = 732.6507$$

$$\Rightarrow X^2_{tab} = ? \text{ ,with } ,\alpha = 0.05$$

$$\Rightarrow \text{degree of freedom} = (2-1) \times (2-1) = 1$$

$$\Rightarrow \text{from the table , } X^2_{tab} = 3.841$$

$\Rightarrow$ Note ,$X^2_{cal} > X^2_{tab}$,so we reject H_o and accept H_a that there is association between mongolism in babies and hepatitis A injection of mothers during pregnancy

1. The following data shows the age and price data of 6 randomly selected cars between 1 and 6 years old. (calculated in thousands of dollars)

Age of car(x)	6	2	5	4	5	1
Price of car(y)	290	384	315	355	328	425

a. Determine the equation of the least squares line [6]

Solution

Age(X)	Price(Y)	X^2	XY	Y^2
6	290	36	1740	84100
2	384	4	768	147456
5	315	25	1575	99225
4	355	16	1420	126025
5	328	25	1640	107584
1	425	1	425	180625
Totals/ 23	2097	107	7568	745015

$$\Rightarrow y = ax + b$$

$$\Rightarrow a = \frac{6(7568) - (23)(2097)}{6(107) - (23)^2} = -24.98$$

$$\Rightarrow b = \frac{2097 - (-24.98)(23)}{6} = 445.27$$

$$\Rightarrow y = -24.98x + 445.27$$

b. Use the result obtained in part (a) to predict the price of a 3 year old car [2]

Solution

$$\Rightarrow \text{price of a 3 year old car,}$$

$$\Rightarrow x = 3$$

$$\Rightarrow y = -24.98x + 445.27$$

$$\Rightarrow y = -24.98(3) + 445.27 = 370.33$$

c. Calculate the correlation coefficient and use it to explain what type of relationship exists between the variables [4]

Solution

$$\Rightarrow \text{correlation coefficient,}$$

$$\Rightarrow r = \frac{6(7568) - (23)(2097)}{\sqrt{6(107) - (23)^2}\sqrt{6(745015) - (2097)^2}}$$

$$\Rightarrow \frac{-2823}{10.63 \times 269.59} = -0.9851$$

$\Rightarrow$ There is a very strong negative correlation which implies that high price value goes with a low age value and low price value goes with a high age value

d. Calculate the coefficient of determination and explain its significance [3]

Solution

$$\Rightarrow \text{ coefficient of determination }, r^2$$

$$\Rightarrow r^2 = (r)^2 = (-0.9851)^2 = 0.9704$$

$$\Rightarrow \text{as a \% we have, } = 97.04\%$$

$\Rightarrow$ this implies that 97.04% points follows a straight line relationship

THE END