Fitting a Binomial Distribution

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Explain the procedure for fitting a binomial
Distribution

Fitting of probability distribution to a series of observed data helps to predi
occurrence of the required variable in a certain desired interval.

There are many probability distributions of which some can be fitted more
others, depending on the characteristics of the variables. Therefore one ne

Fitting of Binomial Distribution

When a Binomial distribution is to be fitted to an observed data the followi

(i) Find mean $\bar{x} = \dfrac{\sum fx}{\sum f} = np$

(ii) Find $p = \dfrac{\bar{x}}{n}$

(iii) Find $q = 1 - p$

(iv) Write the probability mass function : $P(x) = nC_x p^x q^{n-x}$ $x = 0, 1, 2, \ldots n$

(v) Put $x = 0$; find $P(0) = nC_0 p^0 q^{n-0} = q^n$

(vi) Find the expected frequency of $X = 0$ i.e., $F(0) = N \times P(0)$, where $N = \sum f_i$

(vii) The other expected frequencies are obtained by using the recurrence formula

$$F(x+1) = \frac{n-x}{x+1} \times \frac{p}{q} \times F(x)$$

Example 10.34

A set of three similar coins are tossed 100 times with the following results

Number of heads	0	1	2	3
Frequency	36	40	22	2

ict the probability or to forecast the frequency of

closely to the observed frequency of the data than
eds to select a distribution that suits the data well.

ng procedure is adopted:-

Fit a binomial distribution and estimate the expected frequencies.

Solution :

x	f	fx
0	36	0
1	40	40
2	22	44
3	2	44
Total	100	90

(i) Mean $\overline{x} = \frac{\sum fx}{\sum f} = \frac{90}{100} = 0.9$

(ii) $p = \frac{\overline{x}}{n} = \frac{0.9}{3} = 0.3$

(iii) $q = 1 - p = 1 - 0.3 = 0.7$

(iv) $P(x) = nC_x p^x q^{n-x} = 3C_x\ 0.3_x\ 0.7^{3-x}$

(v) $P(0) = 3C_0\ 0.3^0\ (0.7)^{3-0} = 0.7^3 = 0.343$

(vi) $F(0) = N \times P(0) = 100 \times 0.343 = 34.3$

(vii) $F(x+1) = \frac{n-x}{x+1} \times \frac{p}{q} \times F(x)$

$\therefore \quad F(1) = F(0+1) = \frac{3-0}{0+1} \times \frac{0.3}{0.7} \times 34.3 = 44.247$

$F(2) = F(1+1) = \frac{3-1}{1+1} \times \frac{0.3}{0.7} \times 44.247 = 19.03$

$F(3) = F(2+1) = \frac{3-2}{2+1} \times \frac{0.3}{0.7} \times 19.03 = 2.727$

Solution :

(i) The fitted binomial distribution is

$P(X = x) = 3C_x\, 0.3^x\, 0.7\, ^{(3-x)}, \quad x = 0,1,2,3$

(ii) The expected frequencies are :

x	0	1	2	3	Total
Observed frequencies (O_i)	36	40	22	2	100
Expected Frequencies (E_i)	34	44	19	3	100