CSE427 ASSIGNMENT 1

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SECTION: 01

1) p = probability of coin yielding a head

$$p = P(\text{Head}) = \frac{31}{70} = 0.4857$$

2) $P(A) = P(a_1)P(a_2)P(a_3)P(a_4)\ldots\ldots P(a_{10})$

$$\log P(A) = \log P(a_1) + \log P(a_2) + \log P(a_3) + \ldots\ldots + \log P(a_{10})$$

$$-\log P(A) = -\log P(a_1) - \log P(a_2) - \log P(a_3) - \ldots\ldots - \log P(a_{10})$$

(3) $P(a_i) = p^{a_i}(1-p)^{1-a_i}$

(4) $P(A) = p^{a_1}(1-p)^{1-a_1} * p^{a_2}(1-p)^{1-a_2} \ldots\ldots * p^{a_3}(1-p)^{1-a_3}$

$$-\log P(A) = -[a_1 \log p + (1-a_1)\log(1-p)] - \ldots\ldots - [a_{10}\log p + (1-a_{10})(1-p)]$$

$$-\log P(A) = -\sum_{i=1}^{m} x_i \log p - \sum_{i=1}^{m} y_i \log(1-p)$$

Here, $x_i = a_i$

$y_i = 1 - a_i$

$$\frac{-\log P(A)}{mn} = -\frac{\sum_{i=1}^{m} x_i \log p}{mn} - \frac{\sum_{i=1}^{m} y_i}{mn}\log(1-p)$$

Here, m = no. of data (rows)

n = no. of toss (columns)

Let $q = \frac{\sum_{i=1}^{m} x_i}{mn}$

$$-\frac{\log P(A)}{mn} = -q \log p - (1-q)\log(1-p) \quad \text{Here } 1-a_i = 1-q = \frac{\sum_{i=1}^{m} y_i}{mn}$$

$$\frac{d}{dp} \Rightarrow 0 = -q\left(\frac{1}{p}\right) + (1-q)\left(\frac{1}{1-p}\right)$$

$$\Rightarrow q\left(\frac{1}{p}\right) = (1-q)\left(\frac{1}{1-p}\right)$$

$$\Rightarrow \frac{q}{(1-q)} = \frac{1}{(1-p)\left(\frac{1}{p}\right)}$$

$$\Rightarrow \frac{q}{(1-q)} = \frac{1}{\frac{(1-p)}{p}}$$

$$\Rightarrow \frac{q}{(1-q)} = \frac{p}{(1-p)}$$

$$\Rightarrow pq - pq = q - pq$$

$$\Rightarrow \boxed{p = q}$$

(5) $p = q = \sum_{i=1}^{m} \frac{x_i}{mn}$

$= \frac{1}{mn} \sum_{i=1}^{m} x_i$

$= \frac{1}{(10)(7)}(2+2+5+2+4+6+4+4+2+3)$

$p = 0.4857$

(6) number of coins showing heads

$= (20)(0.4857)$

$= [9.71]$

$= 9$