EXAMPLE : TOSSING A COIN

5 HEADS, 0 TAILS

$$\text{ENTROPY}(S) = -\frac{5}{5}\log_2\frac{5}{5} - \frac{0}{5}\log_2\frac{0}{5}$$

$$= 0.0$$

2 HEADS, 2 TAILS

$$\text{ENTROPY}(S) = -\frac{2}{4}\log_2\frac{2}{4} - \frac{2}{4}\log_2\frac{2}{4}$$

$$= 1.0$$

$$\text{ENTROPY}(S) = -(P_{\oplus}) \log_2 P_{\oplus} - P_{\ominus} \log_2 P_{\ominus}$$

$$S : [9+, 5-]$$

$$E = -\frac{9}{14} \log_2 \frac{9}{14} - \frac{5}{14} \log_2 \frac{5}{14}$$

$$= 0.940$$

$$\text{GAIN}(S, \cancel{\text{HUMIDITY}}^{A}) = \text{ENTROPY}(S) - \sum_{v \in \text{values}(A)} \frac{|S_v|}{|S|} \text{ENTROPY}(S_v)$$

$$\text{GAIN}(S, A = \text{HUMIDITY}) = 0.940 - \frac{7}{14} \times \text{ENTROPY}(\text{HUMIDITY} = \text{HIGH}) - \frac{7}{14} \times \text{ENTROPY}(\text{HUMIDITY} = \text{NORMAL})$$

$$\text{ENTROPY}(\text{HUMIDITY} = \text{HIGH}) = -\frac{3}{7}\log_2\frac{3}{7} - \frac{4}{7}\log_2\frac{4}{7}$$

$$\text{ENTROPY}(\text{HUMIDITY} = \text{NORMAL}) = -\frac{6}{7}\log_2\frac{6}{7} - \frac{1}{7}\log_2\frac{1}{7}$$

$$\text{GAIN}(S_{\text{SUNNY}}, \text{HUMIDITY})$$

$$= \text{ENTROPY}(S_{\text{SUNNY}}) - \frac{3}{5}\,\text{ENTROPY}(\text{HUMIDITY} = \text{HIGH})$$

$$- \frac{2}{5} \times \text{ENTROPY}(\text{HUMIDITY} = \text{NORMAL})$$

$$\text{ENTROPY}(S_{\text{SUNNY}}) = -\frac{2}{5}\log_2\frac{2}{5}$$

$$-\frac{3}{5}\log_2\frac{3}{5}$$

$$\text{ENTROPY}(\text{HUMIDITY} = \text{HIGH})$$

$$= -\frac{3}{3}\log 1 - \frac{0}{3}\log 0$$

$$= 0.0$$

$$\text{GAIN}(S_{\text{SUNNY}}, \text{HUMIDITY}) = 0.970$$

$$- \frac{3}{5} \times 0.0 - \frac{2}{5} \times 0.0 = 0.970$$

SIMILARLY,

$$\text{GAIN}(S_{\text{SUNNY}}, \text{TEMPERATURE})$$

$$= 0.970 - \frac{2}{5} \times 0.0 - \frac{2}{5} \times 1.0$$

$$- \frac{1}{5} \times 0.0 = 0.570$$

$$\text{GAIN}(S_{\text{SUNNY}}, \text{WIND})$$

$$= 0.970 - \frac{2}{5} \times 1.0 - \frac{3}{5} \times 0.918$$

$$= 0.019$$