- Entropy of the system = $E(\text{Goes to restaurant}) = E(5,4)$

$= -\frac{5}{9}\log_2\left(\frac{5}{9}\right) - \frac{4}{9}\log_2\left(\frac{4}{9}\right) = 0.9911$

- $E(\text{Budget}) = P(\text{low})E(2,1) + P(\text{medium})E(2,1) + P(\text{high})E(1,2)$

~~$\frac{3}{9}\log_2\left(\frac{3}{9}\right)$~~

$= \left\{\left(\frac{3}{9}\right)\left[-\frac{2}{3}\log_2\left(\frac{2}{3}\right) - \frac{1}{3}\log_2\left(\frac{1}{3}\right)\right]\right\} \times 3 = 0.9183$

- $IG(\text{Budget}) = 0.9911 - 0.9183 = 0.0728$

- $E(\text{Hungry}) = P(\text{No})E(4,1) + P(\text{Yes})E(1,3)$

$= \frac{5}{9}\left[-\frac{4}{5}\log_2\left(\frac{4}{5}\right) - \frac{1}{5}\log_2\left(\frac{1}{5}\right)\right] + \frac{4}{9}\left[-\frac{1}{4}\log_2\left(\frac{1}{4}\right) - \frac{3}{4}\log_2\left(\frac{3}{4}\right)\right]$

$= 0.7616$

- $IG(\text{Hungry}) = 0.9911 - 0.7616 = 0.2295$

- $E(\text{Review}) = P(\text{bad})E(3,2) + P(\text{good})E(2,2)$

$= \frac{5}{9}\left[-\frac{3}{5}\log_2\left(\frac{3}{5}\right) - \frac{2}{5}\log_2\left(\frac{2}{5}\right)\right] + \frac{4}{9}\left[-\frac{2}{4}\log_2\left(\frac{2}{4}\right) - \frac{2}{4}\log_2\left(\frac{2}{4}\right)\right]$

$= 0.9839$

- $IG(\text{Review}) = 0.9911 - 0.9839 = 0.0072$

- Maximum information gain for hungry so hungry will be the first root node.

- Entropy of system = $E(\text{hungry} = NO) = E(4,1)$
$= -\frac{4}{5}\log_2(\frac{4}{5}) - \frac{1}{5}\log_2(\frac{1}{5}) = 0.7219$

- $E(\text{Budget} \mid \text{hungry} = NO) = P(\text{low})E(2,0) + P(\text{medium})E(2,0) + P(\text{high})E(0,1) = 0$

- Entropy is equal to zero so the subtable is pure no need to go further for table (hungry = NO)

- Entropy of system = $E(\text{hungry} = Yes) = E(1,3)$
$= -\frac{1}{4}\log_2(\frac{1}{4}) - \frac{3}{4}\log_2(\frac{3}{4}) = 0.8113$

- $E(\text{Budget} \mid \text{hungry} = Yes) = P(\text{low})E(0,1) + P(\text{medium})E(0,1) + P(\text{high})E(1,1)$
$= 0 + 0 + \frac{2}{4}[-\frac{1}{2}\log_2(\frac{1}{2}) - \frac{1}{2}\log_2(\frac{1}{2})] = 0.5$

- $IG(\text{Budget} \mid \text{hungry} = Yes) = 0.8113 - 0.5 = 0.3113$

- $E(\text{Review} \mid \text{hungry} = Yes) = P(\text{bad})E(1,2) + P(\text{good})E(1,0)$
$= \frac{3}{4}[-\frac{1}{3}\log_2(\frac{1}{3}) - \frac{2}{3}\log_2(\frac{2}{3})] = 0.6887$

- $IG(\text{Review} \mid \text{hungry} = Yes) = 0.8113 - 0.6887 = 0.1226$

- Maximum info. gain at Budget | hungry = Yes so budget is the next root node after hungry = Yes

- All the other subtables are pure down from here so the tree construction will be simple now.