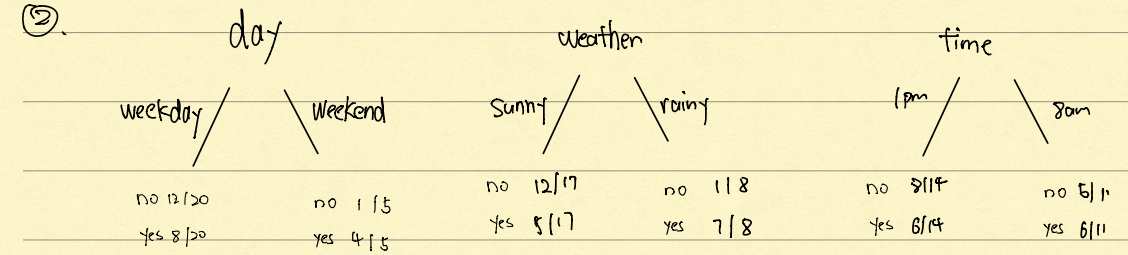
Individual Assignment 1

1. ①. no: 13/25

yes: 12/25

Entropy: $-\frac{13}{25}\log_2(\frac{13}{25}) - \frac{12}{25}\log_2(\frac{12}{25}) = 0.9988$

②.



Entropy

$-\frac{12}{20}\log_2(\frac{12}{20}) - \frac{8}{20}\log_2(\frac{8}{20}) = 0.97$ $-\frac{12}{17}\log_2(\frac{12}{17}) - \frac{5}{17}\log_2(\frac{5}{17}) = 0.87$ $-\frac{8}{14}\log_2(\frac{8}{14}) - \frac{6}{14}\log_2(\frac{6}{14}) = 0.98$

$-\frac{1}{5}\log_2(\frac{1}{5}) - \frac{4}{5}\log_2(\frac{4}{5}) = 0.72$ $-\frac{1}{8}\log_2(\frac{1}{8}) - \frac{7}{8}\log_2(\frac{7}{8}) = 0.54$ $-\frac{5}{11}\log_2(\frac{5}{11}) - \frac{6}{11}\log_2(\frac{6}{11}) = 0.99$

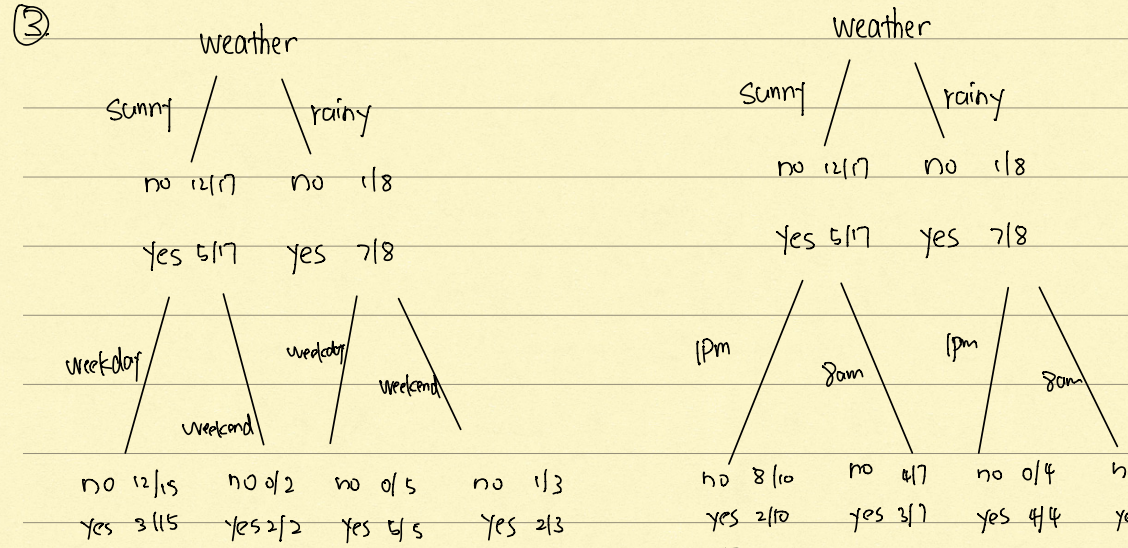
Information

$0.9988 - \frac{20}{25}\times 0.97 - \frac{5}{25}\times 0.72$ $0.9988 - \frac{17}{25}\times 0.87 - \frac{8}{25}\times 0.54$ $0.9988 - \frac{14}{25}\times 0.98 - \frac{11}{26}\times 0.99$

$= 0.0788$ $= 0.2344$ $= 0.0144$

Highest Information Gain

③



Entropy

$-\frac{12}{15}\log_2(\frac{12}{15}) - \frac{3}{15}\log(\frac{3}{15}) = 0.72$ $-\frac{8}{10}\log_2(\frac{8}{10}) - \frac{2}{10}\log_2(\frac{2}{10}) = 0.72$

$-0\log(0) - 1\log(1) = 0$ $-\frac{4}{7}\log_2(\frac{4}{7}) - \frac{3}{7}\log_2(\frac{3}{7}) = 0.99$

$-0\log(0) - 1\log(1) = 0$ $0 = (1)\log(1) - 0\log 0$

$-\frac{1}{3}\log_2(\frac{1}{3}) - \frac{2}{3}\log(\frac{2}{3}) = 0.92$

Information Gain:

$0.9988 - \frac{15}{25} \times 0.72 - \frac{2}{25} \times 0$

$- \frac{5}{25} \times 0 - \frac{3}{25} \times 0.92$

$= 0.4564$

Highest Information Gain

$-\frac{1}{4}\log_2(\frac{1}{4}) - \frac{3}{4}\log_2(\frac{3}{4}) = 0.81$

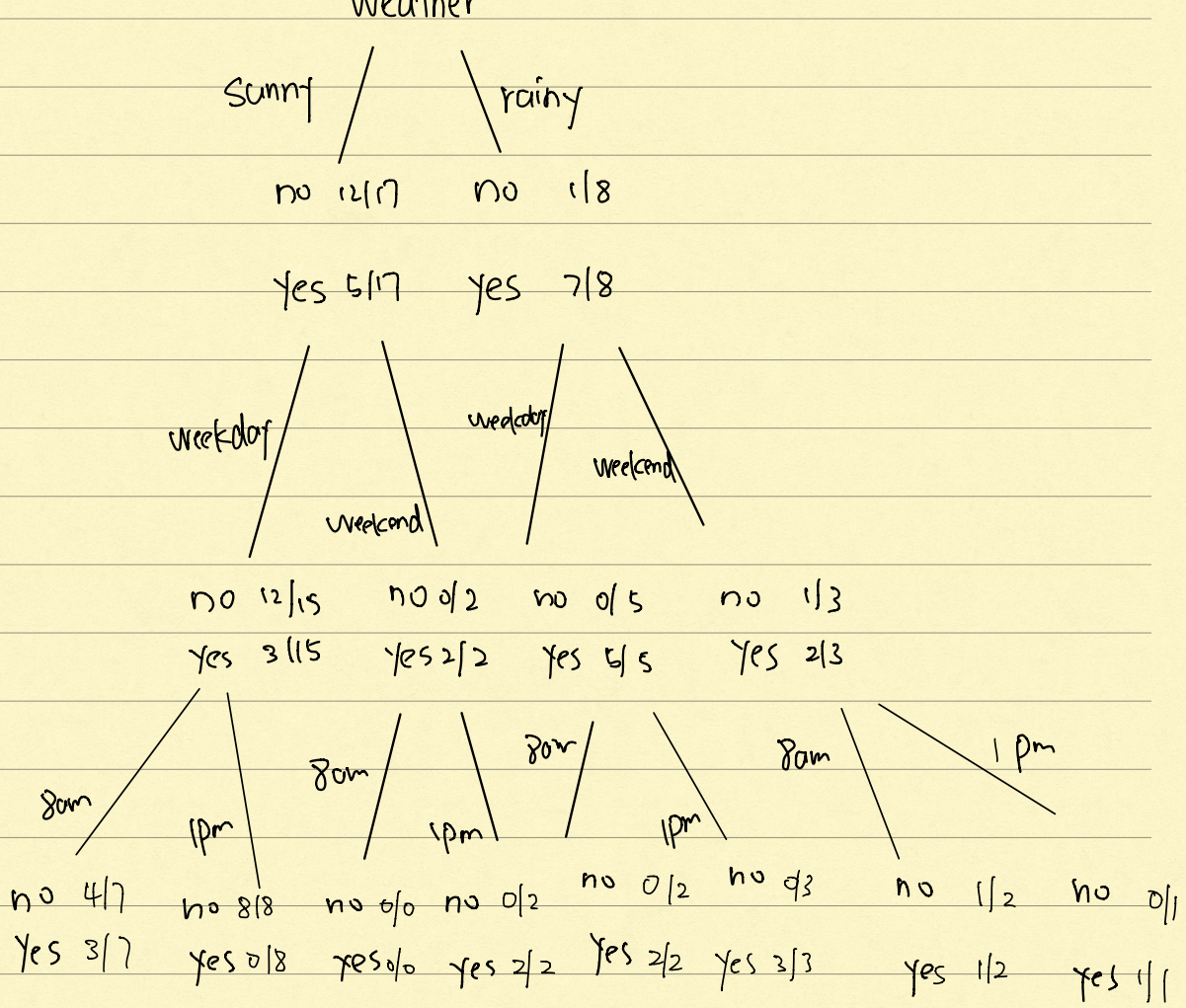
Information Gain:

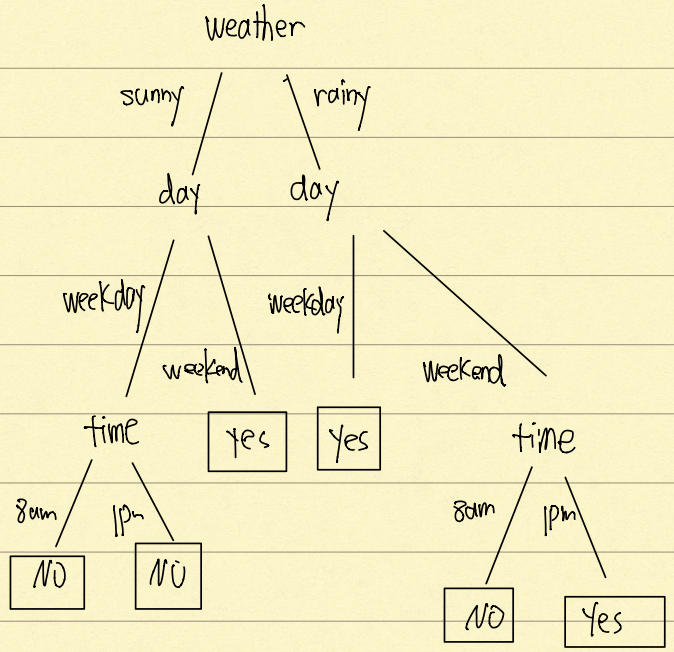
$0.9988 - \frac{10}{25} \times 0.72 - \frac{7}{25} \times 0.99$

$- \frac{4}{25} \times 0 - \frac{4}{25} \times 0.81$

$= 0.304$

④.





2.

day	weather	time	traffic
weekday	sunny	1pm	no
weekday	rainy	1pm	yes
weekday	sunny	8am	no
weekday	sunny	1pm	no
weekday	rainy	1pm	yes
weekday	sunny	8am	no
weekend	rainy	8am	yes
weekend	sunny	1pm	yes
weekday	sunny	8am	yes
weekday	sunny	1pm	no
weekday	sunny	1pm	no
weekend	rainy	1pm	yes
weekday	rainy	1pm	yes
weekday	sunny	8am	no
weekday	sunny	1pm	no
weekend	sunny	1pm	yes
weekday	rainy	8am	yes
weekday	sunny	1pm	no
weekday	sunny	8am	no
weekday	sunny	1pm	no
weekday	sunny	8am	yes
weekend	rainy	8am	no
weekday	sunny	1pm	no
weekday	rainy	8am	yes
weekday	sunny	8am	yes

Prediction

no
yes
no
no
yes
no
no
yes
no
no
no
no
yes
yes
no
no
yes
yes
no
no
no
no
no
no
no
yes
no

		True Class P	True Class N	
Predicted Class	Y	8 (TP)	0 (FP)	8
	N	4 (FN)	13 (TN)	17
		12	13	

Misselassification: $\frac{4}{25} = 0.16$

Sensitivity: $\frac{8}{8+4} = 0.67$

specificity: $\frac{13}{0+13} = 1$

3.

day	weather	time	traffic
weekend	rainy	8am	no
weekday	sunny	8am	yes
weekend	sunny	1pm	yes
weekday	sunny	8am	no
weekend	sunny	1pm	yes
weekday	rainy	8am	no
weekday	sunny	8am	yes
weekday	sunny	1pm	yes
weekday	sunny	1pm	no
weekday	sunny	1pm	no
weekend	rainy	8am	yes
weekday	sunny	8am	yes
weekday	sunny	1pm	no
weekday	rainy	1pm	yes
weekday	sunny	1pm	no

Prediction

no
no
yes
no
yes
yes
no
no
no
no
no
no
yes
no

		True Class P	N
Predicted Class	Y	3 (TP)	1 (FP)
	N	5 (FN)	6 (TN)

Misselassification: $\frac{6}{15} = 0.4$

Sensitivity: $\frac{3}{3+5} = 0.375$

specificity: $\frac{6}{1+6} = 0.857$