

SIMULATE DT TRAINING

PRED.

	STATE	CONTRACT	SEX	CALLS	CHURN		
1	IT	C	F	>10	Y	Y	TP
2	GE	T	M	≤10	N	N	TN
3	IT	T	M	>10	Y	Y	TP
4	GE	Y	F	≤10	N	Y	FP
5	GE	T	F	>10	N	N	TN
6	GE	C	M	>10	Y	Y	TP
7	GE	C	M	≤10	Y	Y	TP
8	GE	Y	F	≤10	Y	Y	TP
9	GE	Y	M	>10	N	N	TN
10	GE	T	F	≤10	N	N	TN
11	GE	Y	F	>10	Y	Y	TP
12	IT	C	F	>10	N	Y	FP

CONSIDER THE MISCLASSIFICATION ERROR

$$ME = 1 - \max \text{ prob.}$$

ROOT $Y = 6$ $ME = \frac{6}{12}$
 $N = 6$

$$\begin{cases} TP = 6 \\ TN = 4 \\ FP = 2 \end{cases}$$

STATE

	IT	GE
Y	2	4
N	1	5

$$ME(IT) = 1/3$$

$$ME(GE) = 4/9$$

$$E = \frac{1}{3} \cdot \frac{3}{12} + \frac{4}{9} \cdot \frac{9}{12} = \frac{5}{12}$$

CONTRACT

	C	T	Y
Y	3	1	2
N	1	3	2

$$ME(C) = 1/4$$

$$ME(T) = 1/4$$

$$ME(Y) = 2/4$$

$$E = \frac{1}{4} \cdot \frac{4}{12} + \frac{1}{4} \cdot \frac{4}{12} + \frac{2}{4} \cdot \frac{4}{12} =$$

$$\boxed{4/12}$$

	C	T	Y
Y	4	2	
N	4	2	

$$ME(C) = 4/8$$

$$ME(Y) = 2/4$$

$$E = \frac{4}{8} \cdot \frac{8}{12} + \frac{2}{4} \cdot \frac{4}{12} = \frac{6}{12}$$

C TY

Y	3	3
N	1	5

$$ME(C) = 1/4 \quad E = \frac{1}{4} \cdot \frac{4}{12} + \frac{3}{8} \cdot \frac{8}{12} = \frac{4}{12}$$

$$ME(TY) = 3/8$$

CY T

Y	5	1
N	3	3

$$ME(CY) = 3/8 \quad E = \frac{3}{8} \cdot \frac{8}{12} + \frac{1}{4} \cdot \frac{4}{12} = \frac{4}{12}$$

$$ME(T) = 1/4$$

SEX

	F	M
Y	3	3
N	4	2

$$ME(F) = 3/7 \quad E = \frac{3}{7} \cdot \frac{7}{12} + \frac{2}{5} \cdot \frac{5}{12} = \frac{5}{12}$$

$$ME(M) = 2/5$$

CALLS

	≤ 10	> 10	
Y	2	4	$ME(\leq 10) = 2/5$
N	3	3	$ME(> 10) = 3/7$

$$E = \frac{2}{5} \cdot \frac{5}{12} + \frac{3}{7} \cdot \frac{4}{12} = \frac{5}{12}$$

SELECT CONTRACT = C

$$Y = 3 \quad N = 1 \quad ME = 1/4$$

STATE

	IT	GE
Y	1	2
N	1	0

$$ME(IT) = 1/2 \quad E = \frac{1}{2} \cdot \frac{2}{4} = \frac{1}{4}$$

$$ME(GE) = \cancel{0}$$

SEX

	F	M
Y	1	2
N	1	0

$$ME(F) = 1/2$$

$$E = \frac{1}{2} \cdot \frac{2}{4} = \frac{1}{4}$$

$$ME(M) = 0$$

CALLS

	≤ 10	> 10
Y	1	2
N	0	1

$$ME(\leq 10) = 0$$

$$ME(> 10) = \frac{1}{3}$$

$$E = \frac{1}{3} \cdot \frac{3}{4} = \frac{1}{4}$$

NO IMPROVEMENT $\Rightarrow$ LEAF

SELECT CONTRACT = T Y=1 N=3
E=1/3

STATE

	IT	GE
Y	1	0
N	0	3

$$ME(IT) = 0 \quad E = 0$$

$$ME(GE) = 0$$

WE CAN STOP WITH STATE BECAUSE
WE HAVE REACHED THE LOWEST ERROR
FOR THE ME SO MAX GAIN

SELECT CONTRACT = Y

$$Y=2 \quad N=2 \quad E=2/4$$

STATE

	π	GE
Y	0	2
N	0	2

$$ME(\pi) = 0 \quad E = \frac{2}{4} \cdot \frac{4}{4} = \frac{2}{4}$$

$$ME(GE) = 2/4$$

SEX

	F	M
Y	2	0
N	1	1

$$ME(F) = 1/3$$

$$ME(M) = 0$$

$$E = \frac{1}{3} \cdot \frac{3}{4} = \frac{1}{4}$$

CALLS

	≤ 10	> 10
Y	1	1
N	1	1

$$ME(\leq 10) = 1/2$$

$$ME(> 10) = 1/2$$

$$E = \frac{1}{2} \cdot \frac{2}{4} + \frac{1}{2} \cdot \frac{2}{4} = \frac{2}{4}$$

SELECT SEX = F

$$Y=2 \quad N=1 \quad E=1/3$$

STATE

	π	GE
Y	0	2
N	0	1

$$ME(\pi) = 0$$

$$ME(GE) = 1/3$$

$$E = \frac{1}{3} \cdot \frac{3}{3} = \frac{1}{3}$$

CALLS

	≤ 10	> 10
Y	1	1
N	1	0

$$ME(\leq 10) = 1/2$$

$$ME(> 10) = 0$$

$$E = \frac{1}{2} \cdot \frac{2}{3} = \frac{1}{3}$$

NO IMPROVEMENTS