Part 2

Level 1:

- choose X_1:	- choose X_2:	choose X_3:
$H(<\frac{3}{5}, \frac{2}{5}>) = 0.97$		
$H(<\frac{2}{4}, \frac{2}{4}>) = 1$	$H(<\frac{2}{2}, \frac{0}{2}>) = 0$	$H(<\frac{2}{3}, \frac{1}{3}>) = 0.92$
$H(<\frac{1}{1}, \frac{0}{1}>) = 0$	$H(<\frac{2}{3}, \frac{1}{3}>) = 0.92$	$H(<\frac{1}{2}, \frac{1}{2}>) = 1$
$Gain = 0.97 - \frac{4}{5} \times 1 = 0.17$	$Gain = 0.97 - \frac{3}{5} \times 0.92 = 0.42$	$Gain = 0.97 - \frac{3}{5} \times 0.92 - \frac{2}{5} \times 1 = 0.02$

We choose X_2 as our root node.

On yes side of X_2 ($X_2 = 1$)

$H(<\frac{1}{3}, \frac{2}{3}>) = 0.92$

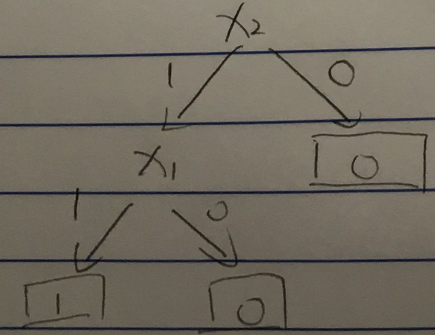
- choose X_1:	- choose X_3:
$H(<\frac{2}{2}, \frac{0}{2}>) = 0$	$H(<\frac{1}{1}, \frac{0}{1}>) = 0$
$H(<\frac{1}{1}, \frac{0}{1}>) = 0$	$H(<\frac{1}{2}, \frac{1}{2}>) = 1$
$Gain = 0.92 - 0 = 0.92$	$Gain = 0.92 - \frac{2}{3} \times 1 = 0.25$

We chose X_1

On no side of X_2 ($X_2 = 0$) ← further

$H(<\frac{2}{2}, \frac{0}{2}>) = 0$, no need to build decision tree

The final decision tree looks like this



part 3

X_1	X_2	w_0	w_1	w_2	Sum	output	target y
0	0	0	0	0	0	0	1
1	1	1	0	1	2	1	0
0	0	0	-1	0	0	0	1
1	0	1	-1	0	0	0	1
0	1	2	0	0	2	1	1
1	1	2	0	0	2	1	0
0	0	1	-1	-1	1	1	1
1	0	1	-1	-1	0	0	1
0	1	2	0	-1	1	1	1
1	1	2	0	-1	1	1	0
0	0	1	-1	-2	1	1	1
1	0	1	-1	-2	0	0	1
0	1	2	0	-2	0	0	1
1	1	3	0	-1	2	1	0
0	0	2	-1	-2	2	1	1
1	0	2	-1	-2	1	1	1
0	1	2	-1	-2	0	0	1
1	1	3	-1	-1	1	1	0
0	0	2	-2	-2	2	1	1
1	0	2	-2	-2	0	0	1
0	1	3	-1	-2	1	1	1
1	1	3	-1	-2	0	0	0
0	0	3	-1	-2	3	1	1
1	0	3	-1	-2	2	1	1

final weight = $w_0 : 3$ $w_1 : -1$ $w_2 : -2$