1.

Since this is a classification problem, the prediction will be the majority vote.

Thus, the final prediction is that the customer would make a claim on the policy.

2.

Tree 1 prediction: Claim amount of 100k

Tree 2 prediction: Claim amount of 70k

Tree 3 prediction: Claim amount of 30k

The final prediction is the average, which is $\frac{100+70+30}{3} = 66.67$

Thus the final prediction is 66.67k

3.

a. The prediction of the first round is the average of y

x	y	Pred1
-1	1	2.666667
2	2	2.666667
4	5	2.666667

b. The target of the second round is the errors of the first round

x	y	Pred1	e1
-1	1	2.666667	-1.66667
2	2	2.666667	-0.66667
4	5	2.666667	2.333333

c. The second round predicts the errors of the first round

x	y	Pred1	e1	Pred 2
-1	1	2.666667	-1.66667	-1.16667
2	2	2.666667	-0.66667	-1.16667
4	5	2.666667	2.333333	2.333333

d. The predictions of y after the second round is the sum of the first round predictions and the second round predictions

x	y	Pred1	e1	Pred2	Final
-1	1	2.666667	-1.66667	-1.16667	1.5
2	2	2.666667	-0.66667	-1.16667	1.5
4	5	2.666667	2.333333	2.333333	5

e. The target of the third round is the errors of the second rounds

x	y	Pred1	e1	Pred2	Final	e2
-1	1	2.666667	-1.66667	-1.16667	1.5	-0.5
2	2	2.666667	-0.66667	-1.16667	1.5	0.5
4	5	2.666667	2.333333	2.333333	5	0

f. The third round predicts the errors of the second round

x	y	Pred1	e1	Pred2	Final	e2	Pred3
-1	1	2.666667	-1.66667	-1.16667	1.5	-0.5	-0.5
2	2	2.666667	-0.66667	-1.16667	1.5	0.5	0.25
4	5	2.666667	2.333333	2.333333	5	0	0.25

g. The predictions of y after the third round is the sum of the first round predictions, the second round predictions and the third round predictions

x	y	Pred1	e1	Pred2	Final	e2	Pred3	Pred_final
-1	1	2.666667	-1.66667	-1.16667	1.5	-0.5	-0.5	1
2	2	2.666667	-0.66667	-1.16667	1.5	0.5	0.25	1.75
4	5	2.666667	2.333333	2.333333	5	0	0.25	5.25

4.

a. Since there are 5 observations, each has a weight of 1/2

	x1	x2	y	Weight 1
0	1	2	1	0.2
1	2	5	1	0.2
2	3	4	-1	0.2
3	4	0	-1	0.2
4	0	1	-1	0.2

b. Predictions of stump 1 are:

	x1	x2	y	Weight 1	Stump 1 pred
0	1	2	1	0.2	1
1	2	5	1	0.2	1
2	3	4	-1	0.2	-1
3	4	0	-1	0.2	-1
4	0	1	-1	0.2	1

Since observation 4 is incorrectly classified, its weight should be increased. All other observations should have their weights decreased, as they were classified correctly.

c.

$\epsilon_1 = 0.2$

$\alpha_1 = L * 0.5 * \ln\left(\frac{1-0.2}{0.2}\right) = 0.$

For the misclassified observations:

$w_{new} = 0.2 * e^{0.693} = 0.4$

For the remaining:

$w_{new} = 0.2 * e^{-0.693} = 0.1$

	x1	x2	y	Weight 1	Stump 1 pred	Weight 2	Stump 2 pred
0	1	2	1	0.2	1	0.125	1
1	2	5	1	0.2	1	0.125	1
2	3	4	-1	0.2	-1	0.125	1
3	4	0	-1	0.2	-1	0.125	-1
4	0	1	-1	0.2	1	0.5	-1

Repeating for rounds 2 and 3:

	x1	x2	y	Weight 1	Stump 1 pred	Weight 2	Stump 2 pred	Weight 3	Stump 3 Pred
0	1	2	1	0.2	1	0.125	1	0.071429	-1
1	2	5	1	0.2	1	0.125	1	0.071429	1
2	3	4	-1	0.2	-1	0.125	1	0.5	-1
3	4	0	-1	0.2	-1	0.125	-1	0.071429	-1
4	0	1	-1	0.2	1	0.5	-1	0.285714	-1

d.

$\epsilon_2 = 0.125$

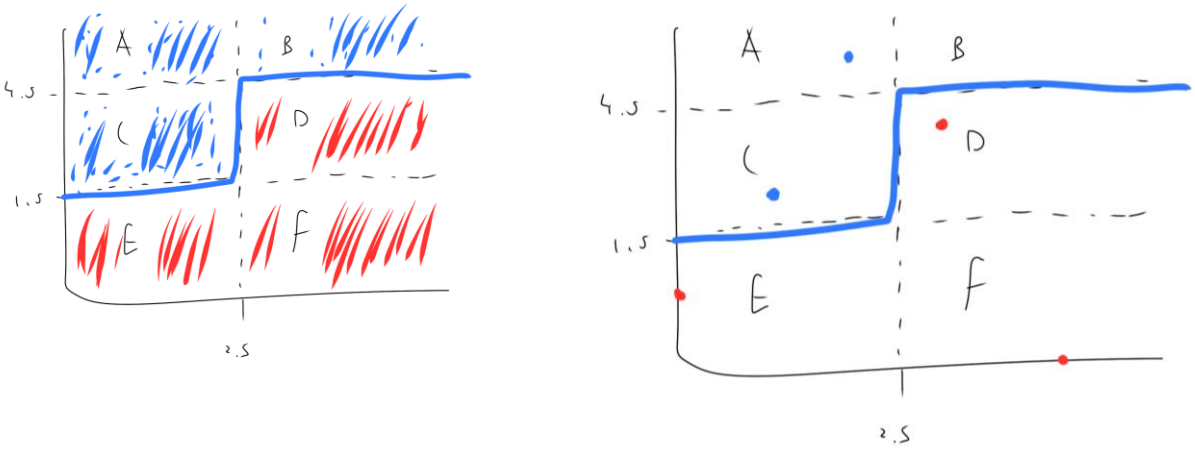
$\epsilon_3 = 0.071429$

$\alpha_2 = 0.972955$

$\alpha_3 = 1.28475$

Stump 3 has the highest voting power, as it has the largest α

e.



f.

We can see that the adaboost perfectly classifies the positives and the negatives.

Therefore, the error is 0.