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Q1.

1. True
Soft margin SVM generally has small value of C.

2. True.

3. d.
The order the instance has no effect on MLP and GBDT.

4. False
The decision boundary is not linear.

5. True.
Random forest is the model used bagging technique. We can sample the train data and train multiple models. Then ensemble the result. This such technique can generate a complex decision boundary.

6. False.

Q2.

if $z > 0$ then

$$\Delta w_i \leftarrow \Delta w_i + \eta \cdot (t - z) x_i$$

else

$$\Delta w_i \leftarrow \Delta w_i + \eta (t - o) x_i$$

$$\frac{\partial E}{\partial w_i} = \frac{\partial}{\partial w_i} \cdot \frac{1}{2} \sum_d (td - Od)^2 = \frac{1}{2} \sum_d \frac{\partial}{\partial w_i} (td - Od)^2 = \frac{1}{2} \sum_d 2(td) - Od) \cdot \frac{\partial}{\partial w_i} (td - Od)$$

$$= -\sum_d (td - Od)\, x_i$$

Q3,

1. Architecture A corresponds to accuracy picture 1

   Architecture B corresponds to picture 2.

   Since CNN B has more complex structure than A (ie. more layers), the accuracy of train should much better that accuracy of test.

2. a). 17X17

   b).

Q4:

1. $x \le 30$.

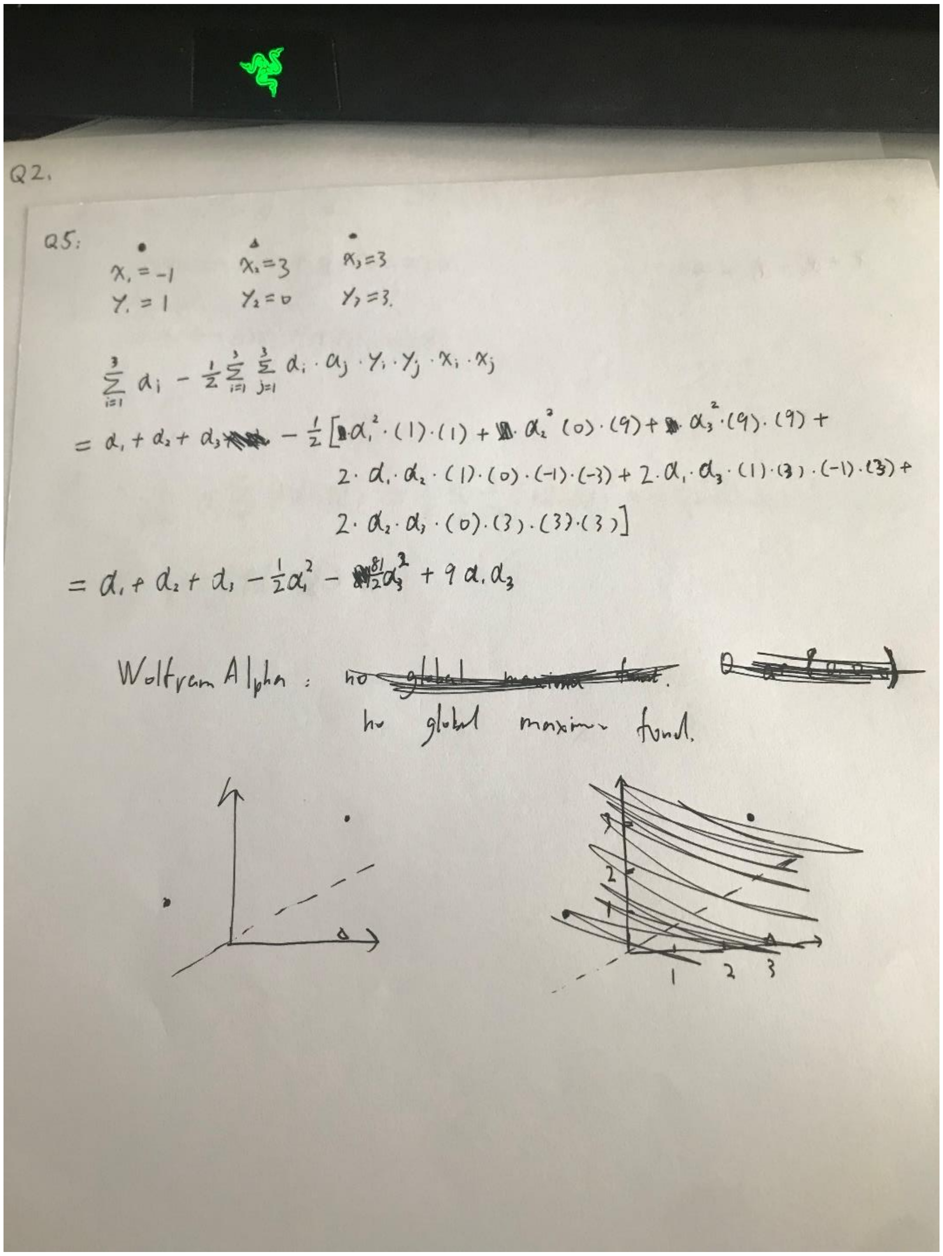
2. $\frac{1}{9} \cdot \frac{1}{2\cdot(1-\frac{2}{9})} = \frac{1}{9} \cdot \frac{1}{2\cdot\frac{7}{9}} = \frac{1}{14}$ $\epsilon_r = \frac{2}{9}$

$\frac{1}{9} \cdot \frac{1}{2\cdot\frac{2}{9}} = \frac{1}{4}$

$10: \frac{1}{14}$	$40: \frac{1}{14}$	$70: \frac{1}{14}$
$20: \frac{1}{14}$	$50: \frac{1}{14}$	$80: \frac{1}{4}$
$30: \frac{1}{14}$	$60: \frac{1}{14}$	$90: \frac{1}{4}$

3: $x \le 70$.

By chosing the decision stump $X \le 70$, the algorithm will end with round 2.



Q2.

Q5:

$x_1 = -1$ $\quad$ $x_2 = 3$ $\quad$ $x_3 = 3$

$y_1 = 1$ $\quad$ $y_2 = 0$ $\quad$ $y_3 = 3.$

$$\sum_{i=1}^{3} \alpha_i - \frac{1}{2}\sum_{i=1}^{3}\sum_{j=1}^{3} \alpha_i \cdot \alpha_j \cdot y_i \cdot y_j \cdot x_i \cdot x_j$$

$$= \alpha_1 + \alpha_2 + \alpha_3 - \frac{1}{2}\Big[\alpha_1^2 \cdot (1)\cdot(1) + \alpha_2^2\,(0)\cdot(9) + \alpha_3^2 \cdot (9)\cdot(9) + 2\cdot\alpha_1\cdot\alpha_2\cdot(1)\cdot(0)\cdot(-1)\cdot(-3) + 2\cdot\alpha_1\cdot\alpha_3\cdot(1)\cdot(3)\cdot(-1)\cdot(3) + 2\cdot\alpha_2\cdot\alpha_3\cdot(0)\cdot(3)\cdot(3)\cdot(3)\Big]$$

$$= \alpha_1 + \alpha_2 + \alpha_3 - \frac{1}{2}\alpha_1^2 - \frac{81}{2}\alpha_3^2 + 9\,\alpha_1\alpha_3$$

Wolfram Alpha : no ~~global maximum found~~.

no global maximum found.

OK, I miss the dot product. Xi*Xj should be replaced. Then calculate the α. Calculate Sign(). Plug in the point, draw the line.