Started on	Monday, 4 March 2024, 5:16 AM
State	Finished
Completed on	Tuesday, 5 March 2024, 10:22 PM
Time taken	1 day 17 hours
Grade	**10.00** out of 10.00 (**100**%)

Question **1**

Correct

Mark 1.00 out of 1.00

The dual problem for the SVM can be formulated as

- $\max \sum_{i=1}^{2M} \lambda_i - \frac{1}{2}\sum_{i,j=1}^{2M} \lambda_i\lambda_j y_i y_j \bar{\mathbf{x}}_i^T \bar{\mathbf{x}}_j$
  subject to $\lambda_i \leq 0$
- $\max \frac{1}{2}\sum_{i,j=1}^{2M} \lambda_i\lambda_j y_i y_j \bar{\mathbf{x}}_i^T \bar{\mathbf{x}}_j$
  subject to $\lambda_i \leq 0$
  $$\sum_{i=1}^{2M} \lambda_i y_i \geq 0$$
- $\max \sum_{i=1}^{2M} \lambda_i - \frac{1}{2}\sum_{i,j=1}^{2M} \lambda_i\lambda_j y_i y_j \bar{\mathbf{x}}_i^T \bar{\mathbf{x}}_j$
  subject to $\lambda_i \geq 0$
  $$\sum_{i=1}^{2M} \lambda_i y_i = 0$$
- $\max \sum_{i=1}^{2M} \lambda_i + \frac{1}{2}\sum_{i,j=1}^{2M} \lambda_i\lambda_j y_i y_j \bar{\mathbf{x}}_i^T \bar{\mathbf{x}}_j$
  subject to $\lambda_i = 0$
  $$\sum_{i=1}^{2M} \lambda_i y_i = 0$$

Your answer is correct.

The correct answer is:

$\max \sum_{i=1}^{2M} \lambda_i - \frac{1}{2}\sum_{i,j=1}^{2M} \lambda_i\lambda_j y_i y_j \bar{\mathbf{x}}_i^T \bar{\mathbf{x}}_j$

subject to $\lambda_i \geq 0$

$$\sum_{i=1}^{2M} \lambda_i y_i = 0$$

Question **2**

Correct

Mark 1.00 out of 1.00

How to calculate constant b in the SVM?

- For any point for which $\lambda_i = 0$, solve $y_i(\bar{\mathbf{a}}^T\bar{\mathbf{x}}_i + b) - 1 = 0$
- For any point for which $\lambda_i = 0$, solve $y_i(\bar{\mathbf{a}}^T\bar{\mathbf{x}}_i + b) = 0$
- For any point for which $\lambda_i = 0$, solve $y_i(\bar{\mathbf{a}}^T\bar{\mathbf{x}}_i + b) + 1 = 0$
- For any point for which $\lambda_i \neq 0$, solve $y_i(\bar{\mathbf{a}}^T\bar{\mathbf{x}}_i + b) - 1 = 0$

Your answer is correct.

The correct answer is:

For any point for which $\lambda_i \neq 0$, solve $y_i(\bar{\mathbf{a}}^T\bar{\mathbf{x}}_i + b) - 1 = 0$

Question **3**

Correct

Mark 1.00 out of 1.00

The **kernel SVM** problem can be defined as

- (selected) $\max \sum_{i=1}^{2M} \lambda_i - \frac{1}{2}\sum_{i,j=1}^{2M} \lambda_i\lambda_j y_i y_j K(\bar{\mathbf{x}}_i, \bar{\mathbf{x}}_j)$
  subject to $\lambda_i \geq 0$
  $$\sum_{i=1}^{2M} \lambda_i y_i = 0$$
  ✔
- $\max \sum_{i=1}^{2M} \lambda_i - \frac{1}{2}\sum_{i,j=1}^{2M} \lambda_i\lambda_j y_i y_j \bar{\mathbf{x}}_i^T \bar{\mathbf{x}}_j$
  subject to $\lambda_i \geq 0$
  $$\sum_{i=1}^{2M} \lambda_i y_i = 0$$
- $\max \frac{1}{2}\sum_{i,j=1}^{2M} \lambda_i\lambda_j y_i y_j K(\bar{\mathbf{x}}_i, \bar{\mathbf{x}}_j)$
  subject to $\lambda_i \geq 0$
  $$\sum_{i=1}^{2M} \lambda_i y_i = 0$$
- $\max \sum_{i=1}^{2M} \lambda_i - \frac{1}{2}\sum_{i,j=1}^{2M} \lambda_i\lambda_j y_i y_j K(\bar{\mathbf{x}}_i, \bar{\mathbf{x}}_j)$
  subject to $\lambda_i \leq 0$
  $$\sum_{i=1}^{2M} \lambda_i y_i \geq 0$$

Your answer is correct.

The correct answer is:

$\max \sum_{i=1}^{2M} \lambda_i - \frac{1}{2}\sum_{i,j=1}^{2M} \lambda_i\lambda_j y_i y_j K(\bar{\mathbf{x}}_i, \bar{\mathbf{x}}_j)$

subject to $\lambda_i \geq 0$

$$\sum_{i=1}^{2M} \lambda_i y_i = 0$$

Question **4**

Correct

Mark 1.00 out of 1.00

The kernel $K(\bar{\mathbf{x}}_i, \bar{\mathbf{x}}_j) = \left(\bar{\mathbf{x}}_i^T \bar{\mathbf{x}}_j\right)^2$ can be written as $\phi^T(\bar{\mathbf{x}}_i)\phi(\bar{\mathbf{x}}_j)$, where $\phi(\bar{\mathbf{x}}_j)$ is defined as

- $\bar{\mathbf{x}}_j^T \bar{\mathbf{x}}_j$
- $\bar{\mathbf{x}}_j \odot \bar{\mathbf{x}}_j$
- $\bar{\mathbf{x}}_j \otimes \bar{\mathbf{x}}_j$ ✔
- $\left(\bar{\mathbf{x}}_j^T + \bar{\mathbf{x}}_j\right)^T \left(\bar{\mathbf{x}}_i^T + \bar{\mathbf{x}}_j\right)$

Your answer is correct.

The correct answer is:

$\bar{\mathbf{x}}_j \otimes \bar{\mathbf{x}}_j$

Question **5**

Correct

Mark 1.00 out of 1.00

The Gaussian kernel is defined as

- $\exp\left(\frac{\|\bar{\mathbf{x}}_i - \bar{\mathbf{x}}_j\|^2}{2\sigma^2}\right)$
- $\exp\left(-\frac{\|\bar{\mathbf{x}}_i - \bar{\mathbf{x}}_j\|^2}{2\sigma^2}\right)$ ✔
- $\exp\left(-\frac{\|\bar{\mathbf{x}}_i - \bar{\mathbf{x}}_j\|}{2\sigma^2}\right)$
- $\|\bar{\mathbf{x}}_i - \bar{\mathbf{x}}_j\| \exp\left(-\frac{\|\bar{\mathbf{x}}_i - \bar{\mathbf{x}}_j\|}{2\sigma^2}\right)$

Your answer is correct.

The correct answer is:

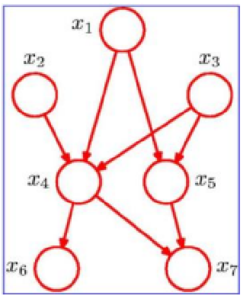
$\exp\left(-\frac{\|\bar{\mathbf{x}}_i - \bar{\mathbf{x}}_j\|^2}{2\sigma^2}\right)$

Question **6**

Correct

Mark 1.00 out of 1.00

Consider the graphical model shown



The joint PDF $p(x_1, x_2, x_3, x_4, x_5, x_6)$ for this can be simplified as

- $p(x_1) \times p(x_2) \times p(x_3) \times p(x_4) \times p(x_5) \times p(x_6) \times p(x_7)$
- $p(x_1) \times p(x_2) \times p(x_3) \times p(x_4|x_1,x_2,x_3) \times p(x_5|x_1,\ x_3) \times p(x_6|x_4) \times p(x_7|x_4,x_5)$ ✔
- $p(x_1) \times p(x_1|x_2) \times p(x_1|x_3) \times p(x_4|x_1,x_2,x_3) \times p(x_5|x_1,\ x_3) \times p(x_6|x_4) \times p(x_7|x_4,x_5)$
- $p(x_1) \times p(x_1|x_2) \times p(x_1,x_2|x_3) \times p(x_1,x_2,x_3|x_4) \times p(x_1,x_2,x_3,x_4|x_5) \times p(x_1,x_2,x_3,x_4,x_5|x_6) \times p(x_1,x_2,x_3,x_4,x_5,x_6|x_7)$

Your answer is correct.

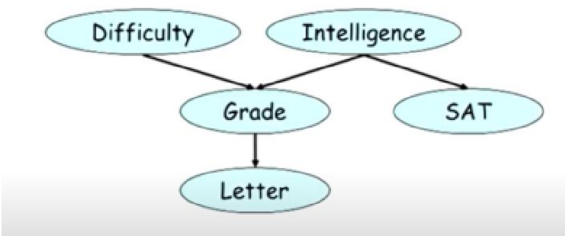
The correct answer is:
$p(x_1) \times p(x_2) \times p(x_3) \times p(x_4|x_1,x_2,x_3) \times p(x_5|x_1,\ x_3) \times p(x_6|x_4) \times p(x_7|x_4,x_5)$

Question **7**

Correct

Mark 1.00 out of 1.00

The joint PDF $p(D,I,\ G,\ L,\ S)$ for the model below can be evaluated as



- $p(D) \times p(I) \times p(G|D,I) \times p(L|G) \times p(S|I)$ ✔
- $p(D) \times p(I|D) \times p(D,I|G) \times p(G|L) \times p(I|S)$
- $p(D) \times p(I) \times p(G) \times p(S) \times p(L)$
- $p(D) \times p(D|I) \times p(D,I|G) \times p(D,I,\ G|L) \times p(D,I,\ G,\ L|S)$

Your answer is correct.

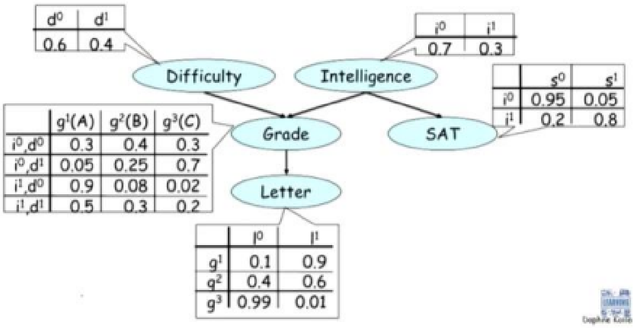
The correct answer is:
$p(D) \times p(I) \times p(G|D,I) \times p(L|G) \times p(S|I)$

Question **8**

Correct

Mark 1.00 out of 1.00

Consider the model below



$p(d^0, i^1, g^1, s^1, l^1)$ can be evaluated as approximately

- 0.27
- 0.05
- 0.12
- 0.45

Your answer is correct.

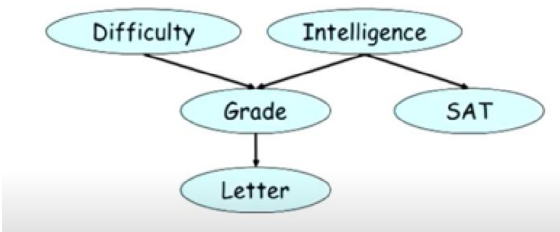
The correct answer is:
0.12

Question **9**

Correct

Mark 1.00 out of 1.00

Consider the model



The quantity $p(l^1 | i^0, d^0)$ is an example of

- Evidential Reasoning
- Intercausal Reasoning
- Not possible to evaluate
- Causal reasoning

Your answer is correct.

The correct answer is:
Causal reasoning

Question **10**

Correct

Mark 1.00 out of 1.00

The quantity $p(i^1 | g^2, d^1)$ is an example of

- Evidential Reasoning
- Intercausal Reasoning ✔
- Not possible to evaluate
- Causal reasoning

Your answer is correct.

The correct answer is:
Intercausal Reasoning