

# ENTROPY 2019 - QUALIFICATION ROUND

## Statistics and Probability

The questions will be multiple choice of 4 choices, 1 CORRECT ANSWER for each question.

If you have any questions, please contact ENTROPY's hotline: (028) 3724 6560 or 0937 367 366

### Question 1

There always have two factors of risk and uncertainty in _____ models	
A	Deterministic
B	Probabilistic
C	Both A and B
D	None of the above

☐ A

☐ B

☒ C

☐ D



## Question 2

The Bayes risk for a decision problem is zero when	
A	The class distributions $P(X Y)$ do not overlap
B	The training data is linearly separable
C	The loss function $L(z, y)$ is symmetrical
D	The Bayes decision rule perfectly classifies the training data

☐ A

☐ B

☐ C

☐ D

## Question 3

In solving the least-squares linear regression, we often impose a Gaussian prior on the weights, and it is equivalent to	
A	Solving a logistic regression problem
B	Adding a Laplace-distributed penalty term
C	$L_2$ regularization
D	$L_1$ regularization

☐ A

☐ B

☐ C

☐ D



## Question 4

Which of the following is the accurate statement of Ridge regression?	
A	It is more sensitive to outliers than ordinary least-squares
B	It reduces variance at the expense of higher bias
C	It adds an $L_1$ -norm penalty to the cost function
D	It often sets several of the weights to zero

☐ A☐ B☒ C☐ D

## Question 5

There are two players A and B who play a game of chance. The initial rule is who wins 3 games will be the eventual winner and get a reward of \$60, where for each game the probability of winning for each man is 0.5. However, after 3 games where A won 2 and B won 1, the game is interrupted. What is a reasonable rewards for A and B?	
A	40-20 (A receives 40\$, B receives 20\$)
B	45-15 (A receives 45\$, B receives 15\$)
C	36-24 (A receives 36\$, B receives 24\$)
D	50-10 (A receives 50\$, B receives 10\$)

☒ A☐ B☐ C☐ D

## Question 6

There are two players A and B playing a fair game, that is, the probability of winning for each one is  $1/2$ . The winner of a game will take \$1 from the loser. If A initially had \$10 and B had \$15 and the game continues until one loses all of his money, what is the probability of A winning all \$25?

A	$1/2$
B	$2/3$
C	$3/4$
D	$2/5$

☐ A

☐ B

☐ C

☐ D



## Question 7

A dangerous disease was found randomly in the general population with probability of 0.0013%. If one is infected, a testing method gives the correct result with 70% probability. If one is not infected, this testing methods gives the correct result with 90% probability. If a test result says that a man is infected, what is the probability that he actually has the disease?

A	1
B	0.00091
C	0.091
D	0.000091

- ☐ A
- ☐ B
- ☐ C
- ☐ D



## Question 8

According to a survey, there is up to 10% of athletes who use doping. A test gives correct result with probability of 90%, regardless of whether the athlete used doping or not. If Maria gets a positive result from her test, what is the probability that Maria actually dopes?

A	1
B	$1/2$
C	$1/4$
D	$2/3$

☐ A☐ B☐ C☐ D

## Question 9

When is an event  $A$  independent of itself?

A	Always
B	If and only if $P(A) = 0$
C	If and only if $P(A) = 1$
D	If and only if $P(A) = 0$ or $1$

☐ A☐ B☐ C☐ D

## Question 10

The probability density function of a Markov process is

A	$p(x_1, x_2, x_3, \dots, x_n) = p(x_1)p(x_2 x_1)p(x_3 x_2) \dots p(x_n x_{n-1})$
B	$p(x_1, x_2, x_3, \dots, x_n) = p(x_1)p(x_1 x_2)p(x_2 x_3) \dots p(x_{n-1} x_n)$
C	$p(x_1, x_2, x_3, \dots, x_n) = p(x_1)p(x_2)p(x_3) \dots p(x_n)$
D	$p(x_1, x_2, x_3, \dots, x_n) = p(x_1)p(x_2x_1)p(x_3x_2) \dots p(x_nx_{n-1})$

☐ A

☐ B

☐ C

☐ D

## Question 11

Consider a linear regression model in case of number of data point is three with input-output pairs as follows:  $y_1 = 22, x_1 = 1, y_2 = 3, x_2 = 1, y_3 = 3, x_3 = 2$ . What is the gradient of mean-square error (MSE) with respect to  $\beta_1$  when  $\beta_0 = 0$  and  $\beta_1 = 1$ ?

A	-1.66 (deviation 0.01)
B	-4.66 (deviation 0.001)
C	1.86 (deviation 0.01)
D	1.12 (deviation 0.001)

☐ A

☐ B

☐ C

☐ D



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