

NPTEL DATA SCIENCE FOR ENGINEERS

ASSIGNMENT 4

1) Identify the correct statements.

I-When the output is a numerical variable, optimization is used to find the best functional representation for data

II-When the output is a categorical variable, in specific a class label, optimization is used to find the best hyperplane to classify data

a) I-TRUE, II-TRUE

b) I-TRUE, II-FALSE

c) I-FALSE, II-TRUE

d) I-FALSE, II-FALSE

Ans- a

2) A knowledge of the different optimization algorithms helps in understanding the underlying process of machine learning algorithms.

a) TRUE

b) FALSE

Ans- a

3) The different types of optimization problems are based on :-

a) Constraints alone

b) Constraints and objective function

c) Constraints, objective function and variables

d) decision variables

Ans- c

4) The class of optimization problems where the decision variables takes a value of either 0 or 1 is:-

a) Boolean integer programming problem

b) Binary integer programming problem

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Ans- b

5) If $f(x) = x^4 - 3x^3 + x^2 + 10$, then the first order necessary condition for either maxima or minima of $f(x)$ is

a) $4x^3 - 9x^2 + 2x = 0$

b) $4x^3 - 8x^2 + 2x = 0$

c) $4x^3 - 9x^2 - 2x = 0$

d) $4x^3 + 9x^2 - 2x = 0$

Ans- $\frac{\partial f}{\partial x} = 4x^3 - 9x^2 + 2x$

$$\frac{\partial f}{\partial x} = 0$$

6) For the function $f(x) = x^4 - 3x^3 + x^2 + 10$, which of the following points are stationary point(s) of $f(x)$?

a) 0

b) 2

c) $\frac{1}{4}$

d) 1

$$\frac{\partial f}{\partial x} = 0$$

$$x(4x^2 - 9x + 2) = 0$$

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$$x(4x^2 - 8x - x + 2) = 0$$

$$x(4x(x - 2) - 1(x - 2)) = 0$$

$$x(4x - 1)(x - 2) = 0$$

$$x = 0, 2, 1/4$$

7) For the function $f(x) = x^4 - 3x^3 + x^2 + 10$, the stationary point which qualifies to maximize the value of $f(x)$ is

a) 0

b) 2

c) $1/4$

d) -1

Ans- Condition for maximizer $f''(x) < 0$; $f''(x) = 12x^2 - 18x^2 + 2$

$$f''(0) = 2 > 0$$

$$f''\left(\frac{1}{4}\right) = -1.75 < 0$$

$$f''(2) = 14 > 0$$

8) For the function $f(x) = x^4 - 3x^3 + x^2 + 10$, the stationary points which qualify to minimize the value of $f(x)$ is

a) 0

b) 2

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c) $\frac{1}{4}$

d) 1

Condition for minimizer $f''(x) > 0$; $f''(x) = 12x^2 - 18x + 2$

$$f''(0) = 2 > 0$$

$$f''\left(\frac{1}{4}\right) = -1.75 < 0$$

$$f''(2) = 14 > 0$$

9) For the function $f(x) = x^4 - 3x^3 + x^2 + 10$, $x^* = 2$ is the

a) **global minimum**

b) local minimum

c) local maximum

d) global maximum

Ans-a

$$f(x) = x^4 - 3x^3 + x^2 + 10$$

$$f(0) = 10$$

$$f(2) = 6$$

$$f(2) < f(0)$$

Therefore, $x^* = 2$, is a global minimum