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NPTEL (<https://swayam.gov.in/explorer?ncCode=NPTEL>) » **Data Science for Engineers (course)**

 Announcements (announcements) **About the Course** (https://swayam.gov.in/nd1_noc20_cs28/preview)

Ask a Question (forum) Progress (student/home) Mentor (student/mentor)

Unit 7 - Week 5

Course outline

How does an NPTEL online course work?

Week 0
Week 1
Week 2
Week 3
Week 4
Week 5
☒ Multivariate Optimization With Equality Constraints (unit? unit=36&lesson=37)

☐ Multivariate Optimization With Inequality Constraints (unit? unit=36&lesson=38)

☐ Introduction to Data Science

Assignment 5

The due date for submitting this assignment has passed. **Due on 2020-03-04, 23:59 IST.**
As per our records you have not submitted this assignment.

1) In an unconstrained multivariate optimization problem, if the objective function is $f(x)$ then the first order derivative ∇f is called **1 point**

- ☐ gradient
☐ hessian
☐ polarization
☐ all the above

No, the answer is incorrect.

Score: 0

Accepted Answers:
gradient

2) For an unconstrained multivariate optimization given $f(\bar{x})$, the necessary second order condition for \bar{x}^* to be the minimizer of $f(\bar{x})$ is **1 point**

- ☐
 $\nabla^2 f(\bar{x}^*)$ must be negative definite
☐
 $\nabla f(\bar{x}^*) = 0$
☐
 $\nabla^2 f(\bar{x}^*)$ must be positive definite
☐
 $f''(x^*) > 0$

No, the answer is incorrect.

Score: 0

Accepted Answers:

(unit?
unit=36&lesson=39)

☒ Solving Data
Analysis
Problems - A
Guided Thought
Process (unit?
unit=36&lesson=40)

☒ Dataset (unit?
unit=36&lesson=41)

☒ FAQ (unit?
unit=36&lesson=42)

☐ Quiz : Practice
Assignment 5
(assessment?
name=94)

☒ Quiz :
Assignment 5
(assessment?
name=118)

☐ Week 5
Feedback (unit?
unit=36&lesson=121)

☐ Solution -
Assignment 5
(unit?
unit=36&lesson=125)

Week 6

Week 7

Week 8

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$\nabla^2 f(\bar{x}^*)$ must be positive definite

3) Which of the following statements is/are **not TRUE** with respect to the multi variate optimization

1 point

- I - The gradient of a function at a point is parallel to the contours
- II - Gradient points in the direction of greatest increase of the function
- III - Negative gradients points in the direction of the greatest decrease of the function
- IV - Hessian is a non-symmetric matrix

- ☐ I
- ☐ II and III
- ☐ I and IV
- ☐ III and IV

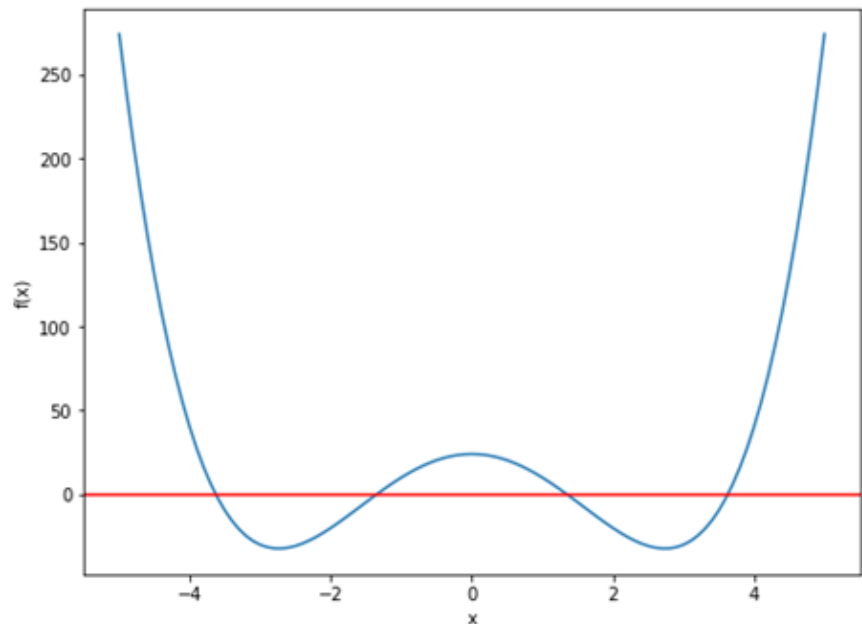
No, the answer is incorrect.
Score: 0

Accepted Answers:
I and IV

4) Consider the below plot to answer the question. In this plot the decision variable (x) is along the x-axis and objective

1 point

function $f(x)$ is on the y axis



Using this graphical representation calculate the number of roots available?

- ☐ 2
- ☐ 6
- ☐ 5
- ☐ 4

No, the answer is incorrect.
Score: 0

Accepted Answers:
4

5) For a function $f(x, y) = -2x^2 + 3xy + 3y^2 + 6x - y$ the stationary point (x, y) is (Hint: Stationary point is a solution to the first order necessary conditions for maxima or minima of $f(x, y)$)

1 point

- ☐ (13/11, -14/33)
- ☐ (1,1)
- ☐ (0,2)
- ☐ (3/5, 2/5)

No, the answer is incorrect.

Score: 0

Accepted Answers:

(13/11, -14/33)

6) The hessian matrix of $f(x, y) = -4x^2 + 3xy + 4y^2 + 4x - y$

1 point

- ☐ $\begin{bmatrix} -5 & 2 \\ 2 & 5 \end{bmatrix}$
- ☐ $\begin{bmatrix} 3 & 4 \\ 8 & 1 \end{bmatrix}$
- ☐ $\begin{bmatrix} -5 & 2 \\ 2 & 8 \end{bmatrix}$
- ☐ $\begin{bmatrix} -8 & 3 \\ 3 & 8 \end{bmatrix}$

No, the answer is incorrect.

Score: 0

Accepted Answers:

$\begin{bmatrix} -8 & 3 \\ 3 & 8 \end{bmatrix}$

7) Consider the hessian matrix $H(\bar{x}^*) = \begin{bmatrix} -4 & 2 \\ 2 & 4 \end{bmatrix}$. Find the eigen values of $H(\bar{x}^*)$

1 point

- ☐ [4.472136, -4.472136]
- ☐ [5.414214, 5.585786]
- ☐ [-6.324555, 6.324555]
- ☐ [-1.585786, -4.414214]

No, the answer is incorrect.

Score: 0

Accepted Answers:

[4.472136, -4.472136]

8) The eigen values of the Hessian matrix is [35.60, -0.40] then the hessian matrix is

1 point

- ☐ positive definite
- ☐ negative definite
- ☐ indefinite
- ☐ negative semi definite

No, the answer is incorrect.

Score: 0

Accepted Answers:

indefinite

9) The function $f(x, y) = 3x^3 + 3x^2 - 3y^3 + 6y^2$

1 point

- ☐ has a stationary point at $(-2/3, 0)$
- ☐ has a stationary point at $(0, 4/3)$
- ☐ has a stationary point at $(0, 0)$
- ☐ all of the above are stationary points for the function

No, the answer is incorrect.

Score: 0

Accepted Answers:

all of the above are stationary points for the function

10) State whether the following statements are true or false for the gradient based algorithms

1 point

I - Efficient for many variables

II - well suited for smooth objective and constraint functions

- ☐ I - False, II - True
- ☐ I - False, II - True
- ☐ I - True, II - True
- ☐ I - True, II - False

No, the answer is incorrect.

Score: 0

Accepted Answers:

I - True, II - True

11) Gradient based algorithm methods compute

1 point

- ☐ only step length at each iteration
- ☐ both direction and step length at each iteration
- ☐ only direction at each iteration
- ☐ none of the above

No, the answer is incorrect.

Score: 0

Accepted Answers:

both direction and step length at each iteration

12) The stationary point of $f(x_1, x_2) = 8x_1 + 4x_2 + x_1^2 + x_2^2$ is

1 point

- ☐ (0,1)
- ☐ (0,2)
- ☐ (-4, -2)
- ☐ (4,2)

No, the answer is incorrect.

Score: 0

Accepted Answers:

(-4, -2)

Answer the questions 13 to 15 using the function given below

$$f(x_1, x_2) = 30(x_2 - x_1^2)^2 + (1 - x_1)^2$$

13) The stationary point of $f(x_1, x_2)$ is

1 point

- ☐ (-1,1)
- ☐ (1,1)
- ☐ (-1, -1)
- ☐ (1, -1)

No, the answer is incorrect.

Score: 0

Accepted Answers:

(1,1)

14) The Hessian matrix of $f(x_1, x_2)$ evaluated at the stationary point obtained in **Q.13** is

1 point

☐

$$\begin{bmatrix} 400 & -200 \\ -200 & 100 \end{bmatrix}$$

☐

$$\begin{bmatrix} 240 & -120 \\ -120 & 60 \end{bmatrix}$$

☐

$$\begin{bmatrix} 242 & -120 \\ -120 & 60 \end{bmatrix}$$

☐

$$\begin{bmatrix} -400 & -200 \\ -200 & -100 \end{bmatrix}$$

No, the answer is incorrect.

Score: 0

Accepted Answers:

$$\begin{bmatrix} 242 & -120 \\ -120 & 60 \end{bmatrix}$$

15) The eigen values obtained in Hessian matrix **Q.14** is (Round off to two decimal places)

1 point

☐

301.60 and 0.40

☐

500 and 0

☐

501.60 and 0.40

☐

301.60 and -0.40

No, the answer is incorrect.

Score: 0

Accepted Answers:

301.60 and 0.40

