Roll No.

24/3/2018

DOON UNIVERSITY, DEHRADUN

Mid Semester Examination, 2018
Academic Year 2017-18 (Even Semester)

DEPARTMENT OF COMPUTER SCIENCE, SCHOOL OF PHYSICAL SCIENCES

Integrated M.Sc. (Computer Science), Sixth Semester
CSC-353: Optimization Techniques

Time Allowed: 2 hours — ***Maximum Marks:** 30*

SECTION A **(Total Marks: 3 × 2 = 6)**

1 What are the various types of optimization problems? Give examples of each type.

2 Fill up the blanks:

a) A point that satisfies all the constraints is said to be ____.

b) The eigenvalues of a negative definite matrix are ____.

3 Write the Taylor series for a real-valued function of single variable. Also write the formula in remainder form.

SECTION B **(Total Marks: 3 × 4 = 12)**

1 a) What is a pure quadratic function? How do you represent it using a symmetric matrix?

b) Verify positive definiteness of the following matrix.

$$\begin{bmatrix} 4 & 1 & 0 \\ 1 & 5 & 2 \\ 0 & 2 & 6 \end{bmatrix}$$

2 a) Define global and local optimizers for the maximization problem $\max_{\bar{x} \in S} f(\bar{x})$.

b) Consider the problem

$\max f(\bar{x}) = x_1$

subject to $x_1^2 + x_2^2 \leq 25$

$x_1^2 \geq 9$

$x_1 x_2 \geq 0$

Graph the feasible set. Find all local maximizers for the problem and determine which of those are also global maximizers.

3 Let A be a positive semidefinite matrix of order *n*. Show that for any $\alpha > 0$, $(\alpha I + A)$ is always positive definite.

SECTION C **(Total Marks: 2 × 6 = 12)**

1 a) Find the first three terms of the Taylor series for $f(x_1, x_2) = \sqrt{{x_1}^2 + {x_2}^2}$ about the point $\bar{x}_0 = (3, 4)^T$.

b) Evaluate the series at $(4, 4)^T$ and compare with the true value of $f(4, 4)$.

2 Discuss the optimizers of the following functions:

a) $f(x) = 3x^4 - 4x^3 + 1$

b) $f(x_1, x_2) = e^{x_1 - x_2} + e^{x_2 - x_1}$