MA8.401: Topics in Applied Optimization			Marks obtained ↓
Date: 21.09.2024,	Total questions: 3	Total points: 25	
Roll No:	Name:		Time: 90 Minutes

Question:	1	2	3	Total
Points:	10	5	10	25
Score:				

10 1. Answer the following. (1 mark each)

1. Write the optimization problem in standard form. When it is called convex optimization?
2. Define active and inactive constraints.
3. Define $\epsilon-$suboptimal solution.
4. Define feasible set.
5. Write the Lagrangian and dual function for optimization problem in standard form.
6. Is dual function necessarily concave? If yes, prove otherwise give example.
7. Prove that dual function is a lower bound for primal optimal p^*.
8. State Slater condition. Give an example where Slater condition does not hold.
9. Describe finite horizon deterministic problems and corresponding DP algorithm.
10. Write one advantage and one disadvantage of multistep lookahead in DP.

5 2. *(SVM) Answer the following. (1 mark each)*

1. Derive the optimization model for SVM.
2. Derive the dual form.
3. State strong duality. Does strong duality hold for SVM?
4. Write primal form for soft-margin classifier.
5. State in one line why we use soft-margin SVM.

10 3. (Optimization Models) Answer the following.

1. Write the optimization problem for the following (1 marks each):
   (a) Linear Programming
   (b) Quadratic Programming
   (c) Quadratic Programming with Quadratic Constraints
   (d) Conic Programming
   (e) Semi definite Programming
   (f) Quasi convex Optimization
2. Write full KKT conditions for the optimization problem in standard form. (2 marks)
3. (2 marks) Write the KKT conditions and solve the system for the following problem

$$\begin{aligned} \text{minimize} \quad & 2x_1^2 + x_2^2 \\ \text{subject to} \quad & x_1 + x_2 = 1. \end{aligned}$$

Draw level curves of the objective function and equality constraints. Identify and mark the solutions obtained.