

## 國立臺灣科技大學

## 八十九學年度博士班招生考試試題

系所組別：機械工程系甲二組

科目：最佳設計

1. (a) Explain the concept of the Secant method for finding a root of an equation  $f(x)=0$  in the interval  $(a, b)$  if it exists. (10%)  
 (b) What is the definition of a feasible direction? (10%)  
 (c) What is the definition of a usable (descent) direction? (10%)
  
2. Given:  $f(x_1, x_2, x_3) = 4x_1^2 + x_2^2 + x_3^2 + 80x_1 + 20x_2 - 3000$   
 Subject to:  $2x_1 \geq 50$   
 $2x_1 + x_2 \geq 50$   
 $2x_1 + x_2 + x_3 \geq 150$   
 Current design:  $X_0 = \begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix} = \begin{bmatrix} 25 \\ 50 \\ 50 \end{bmatrix}$   
 (a) Reformulate the above problem into a Kuhn-Tucker problem. (10%)  
 (b) Solve for the corresponding values of the Lagrange multipliers at design  $X_0$ . (10%)
  
3. Consider the problem  
 Minimize  $f(x_1, x_2) = x_1^2 + x_2^2$   
 $x_1^2 - x_2 \geq 0$   
 Subject to  $2 - x_1 - x_2^2 = 0$   
 $2.5 \geq x_1 \geq 0.5$   
 $3 \geq x_2 \geq 0$   
 (a) Reformulate the above problem using Sequential Linear Programming at  $(2, 1)$  (Don't need to solve them) (10%)  
 (b) Reformulate the above problem to a unconstrained problem using Exterior Penalty Function Method (Don't need to solve them) (10%)  
 (c) Reformulate the above problem to a unconstrained problem using Augmented Lagrange Multiplier Method (Don't need to solve them) (10%)
  
4. Optimization techniques can be generally divided into two categories: (1) mathematical methods, such as sequential linear programming, the method of feasible direction, the generalized reduced gradient method, etc., and (2) probability methods, such as genetic algorithms and simulated annealing method. The selection depends on the characteristics of your design problem. Please explain your decision factors to select a suitable optimization technique (which method of which category) when you encounter an engineering optimization problem. (20%)

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