

國立臺灣科技大學

九十二學年度博士班招生考試試題

系所組別：機械工程系博士班甲二組

科目：最佳設計

總分
100分

- (25%) Briefly describe three basic operators of the genetic algorithm
- (25%) Solve the problem by the simplex method and starting from $x=0, y=0$

$$\begin{aligned} \text{maximize} \quad & z = 4x + 5y \\ \text{subject to} \quad & -x + y \leq 4 \\ & x + y \leq 6 \\ & x \geq 0 \\ & y \geq 0 \end{aligned}$$
- (25%) Code a subroutine (Using Fortran, C, Basic, or Matlab) to find a stationary point between 1 and 2 for the function $f(x) = (x^2/3) + \cos x$
(Notes: Random search methods are not permitted. $\cos 1 = 0.54$, $\cos 1.5 = 0.07$, $\cos 2 = -0.42$, $\sin 1 = 0.84$, $\sin 1.5 = 0.99$, $\sin 2 = 0.91$)
- (25%) Write an optimization model for the following design problem. The system to be designed is a control valve actuator linkage as shown in the figure below. The crank length, L_c , the rod length, L_r , and the center distance, D_c , are parameters to be determined. L_c and L_r were constrained to be less than 10 cm. The center distance was constrained to be between 5 and 7 cm. The linkage is allowed to rotate from $\theta = 0$ to 90 deg. The initial position and final position of the linkage were also shown in the figure. The piston pressure is given as 20N/cm^2 and the piston diameter was given as 5.5 cm. The coefficient of friction between piston and cylinder was taken as 0.15. The side force, F_x , was constrained to be less than 2000 N. The stroke, S , was constrained to be less than 4 cm. Find the best design such that the output torque, T , is maximized.

