國立勤益科技大學 100 學年度研究所碩士班招生筆試試題卷

所別：工業工程與管理系所　　　　　　　　組別：作業研究

科目：作業研究

准考證號碼：□□□□□□□□（考生自填）

考生注意事項：
一、考試時間 100 分鐘。
二、應考人不得自行攜帶電子計算器，一律由本校統一提供。

試題一：〈 每小題 20 分，共 40 分〉

有一線性規劃問題如下：

$$
\begin{aligned}
&Min\ \ Z = 18x_1 + 6x_2 - x_3 \\
&s.t.\ \ 2x_1 + x_2 - 2x_3 \geq 5 \\
&\qquad 4x_1 + x_2 + x_3 \geq 15 \\
&\qquad x_1 \geq 0, x_2 \geq 0, x_3 \geq 0
\end{aligned}
$$

假設 y_1、 y_2 分別為上述第一及二條功能限制式所對應對偶問題的決策變數。

(1)請寫出上述問題之對偶問題(dual problem)。

(2)此對偶問題的最佳解為何？

試題二：〈 20 分〉

The payoff of the following 3×4 game is for A player. Please solve the problem graphically.

Strategies of A player	Strategies of B player			
	b1	b2	b3	b4
a1	6	3	-1	-2
a2	3	4	6	5
a3	-2	3	5	2

試題三：〈 40 分〉

The following **P** is a 3×3 transition matrix. Please determine the steady-state (long run) probabilities of three states, π_1, π_2 and π_3.

$$
P = \begin{bmatrix} 0.6 & 0.3 & 0.2 \\ 0.1 & 0.7 & 0.1 \\ 0.2 & 0.3 & 0.5 \end{bmatrix}
$$

試題四：〈 20 分〉

True/False: Indicate by "O" = "true" or "X" ="false." (each 2 points, total 20 points)

___ 1. The system **AX = b** has no solution if **A** is singular and **b** is independent of **A**.

___ 2. A "pivot" in the simplex method corresponds to a move from one corner point of the feasible region to another.

___ 3. Adding constraints to an LP may improve the optimal objective function value.

___ 4. If an artificial variable is nonzero in the optimal solution of an LP problem, then the problem has no feasible solution.

___ 5. If you make a mistake in choosing the pivot column in the simplex method, the next basic solution will be infeasible.

___ 6. If a primal minimization LP problem has a cost which is unbounded below, then the dual maximization problem has an objective which is unbounded above.

___ 7. The optimal values of the primal and dual LP problems, if they exist, must be equal.

___ 8. One advantage of the revised simplex method is that it does not require the use of artificial variables.

___ 9. The two-phase method solves for the dual variables in Phase I, and then solves for the primal variables in Phase II.

___ 10. In a transportation problem, if the current dual variables U_2=3 and V_4=1, and C_{24}=2, then the current basic solution cannot be optimal.

試題五：〈 40 分〉

Integer Programming Model Formulation. (Each 8 points, total 40 points)

The NCUT is to form a committee to handle the students' complaints. The committee must include at least one female, one male, one student, and one faculty. Eight individuals (identified by the letters *a* to *h*) have been nominated. The mix of these individuals in the different categories is given as:

Category	Individuals
Females	*a*, *b*, *c*, *d*
Males	*e*, *f*, *g*, *h*
Students	*b*, *c*, *f*,
Faculty	*a*, *d*, *e*, *g*, *h*

Formulate this problem as an integer linear program.

Minimize __________________________________

St. __________________ (1)

__________________ (2)

__________________ (3)

__________________ (4)

$x_i \in \{0, 1\}$

試題六：〈 40 分〉

LP Sensitivity. (Each 8 points, total 40 points)

Consider the following LP problem.

Maximize $z = 3x_1 + 2x_2 + 5x_3$

Subject to

$$
\begin{aligned}
x_1 + 2x_2 + x_3 &\leq 430 \text{ (Operation 1)} \\
3x_1 \qquad + 2x_3 &\leq 460 \text{ (Operation 2)} \\
x_1 + 4x_2 \qquad &\leq 420 \text{ (Operation 3)} \\
x_1 \geq 0,\ x_2 \geq 0,\ x_3 &\geq 0
\end{aligned}
$$

The optimum tableau is:

Basic	x_1	x_2	x_3	x_4	x_5	x_6	RHS
z	4	0	0	1	2	0	1350
x_2	-0.25	1	0	0.5	-0.25	0	100
x_3	1.5	0	1	0	0.5	0	230
x_6	2	0	0	-2	1	1	20

(a) Since operation 3 has the slack capacity of 20 at the optimum solution, if we shift 20 from operation 3 to operation 2, new RHS = __________, new solution (x_2, x_3, x_6) = ___________.

(b) If new objective value z becomes to be $3x_1 + 6x_2 + x_3$, new cost vector C_B = __________, dual variable vector Y = __________. Is the current solution still optimum? Answer “yes” or “no” and show why (no points will be given without showing the computation). __________