

資訊工程學系 入學考試試題

科目： 數學 (含離散數學、線性代數) 第 1 頁共 1 頁

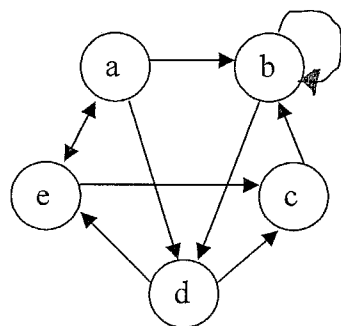


Fig. 1

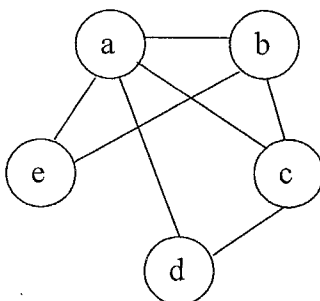


Fig. 2

1. (10%) As shown in Fig. 1, there are 5 vertices in the digraph. Let R be the relation whose digraph is shown in Fig. 1, M_R be the matrix of relation R for the vertices of digraph, M_R^n be the matrix of relation R for all vertices with a path of length n .
 - 1) Find the set of R^2 (by using the Boolean product only). (5%)
 - 2) Find M_R^∞ . (5%)
2. (16%) $S = \{1, 2, 3, 4, 5, 6, 7, 8, 9, 10\}$ in sample space and let $E = \{1, 2, 4, 5, 6, 7\}$, and $F = \{2, 3, 5, 6, 8, 9\}$.
 - 1) Find $\bar{E} + F$, $\|E \cup F\|$, $\overline{E \cap F}$. (12%)
 - 2) How many possible words of the distinguishable permutation of the letters in the word "BOOLEAN-ALGEBRA"? (4%)
3. (12%) As shown in Fig. 2, there are 5 vertices in an undirected graph.
 - 1) How do we identify whether there are Hamiltonian path in an undirected graph or not? (6%)
 - 2) Are there any Hamiltonian path and circuit in Fig. 2? If it exists, please draw a result graph. (6%)
4. (12%) Algebraic Expression: $a*(b+2)-3*(c/d+4)$.
 - 1) Show a binary tree to denote the expression. (6%)
 - 2) What are prefix and postfix searching strings from the trees in 1)? (6%)
5. (10%) If
$$\begin{bmatrix} 1 & -2 & 4 \\ 2 & -1 & 5 \\ -1 & 3 & -3 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix} = \begin{bmatrix} 12 \\ 18 \\ -8 \end{bmatrix}$$
, compute the solution (x_1, x_2, x_3) .
6. (10%) If A and B are 2×2 matrices and $|A| = 3$, $|B| = -2$, compute the determinant $|5AB^{-1}|$.
7. (15%) Determine the inverse and the eigenvalues of the matrix $A = \begin{bmatrix} 15 & 7 & -7 \\ -1 & 1 & 1 \\ 13 & 7 & -5 \end{bmatrix}$.
8. (15%) Find a basis for the subset W of vectors in \mathbf{R}^3 that are orthogonal to vector $w = (1, 3, 1)$.