本試題是否可以使用計算機： ☑可使用 ， □不可使用 （請命題老師勾選）

1. Disprove or prove that for $n \geq 2$, the hypercube Q_n has a Hamilton cycle (Q_3 is shown in Fig. 1).   15%
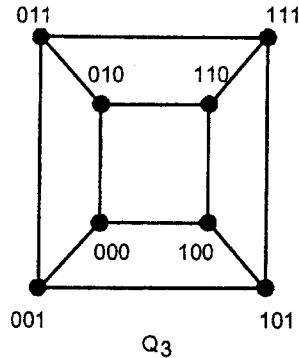

Fig. 1.

2. A pyramid has a square base and 4 faces that are equilateral triangles. If we can move the pyramid in space, how many nonequivalent ways are these to paint its 5 faces if we have paint of 4 different colors?   15%

3. Please design/draw a minimum Moore-type state diagram with two inputs, A and B, and a simple output Z that is 1 if : 1) A had the same value at each of the two previous clock cycles, or 2) B has been 1 since the last time that the first condition was true. Otherwise, the output should be 0.   15%

4. Determine the number of n-digit quaternary (0, 1, 2, 3) sequences in which there is never a 3 anywhere to the right of a 0, using the method of recurrence equations. 15%

5. Let $n \in Z^+$ with $n \geq 4$. How many subgraphs of K_n are isomorphic to the complete bipartite $K_{1,3}$?   15%

6. Let M be the finite state machine given in the state diagram shown in Fig. 2. Find a (minimal) distinguishing string for state s_3 and s_6.   15%
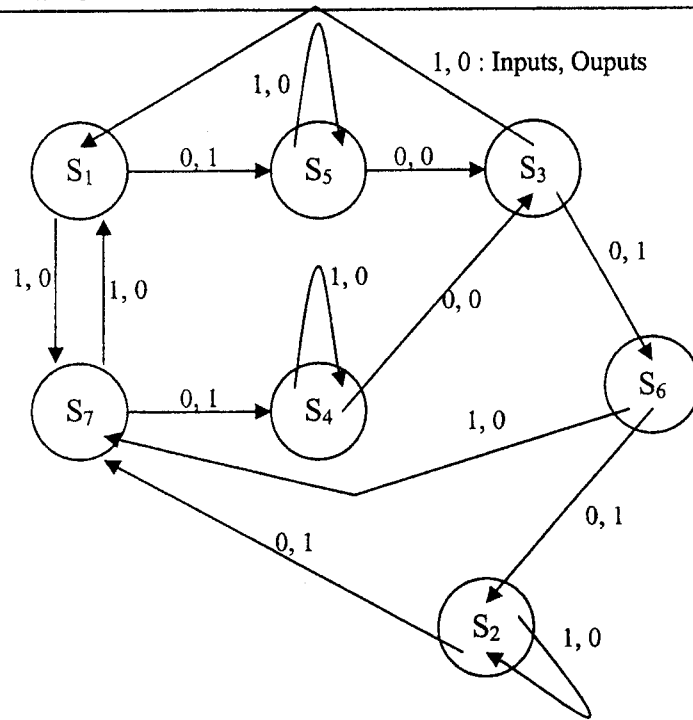
(尚有試題)

（背面仍有題目，請繼續作答）

Fig. 2.

7. A relation R on a set A is called irreflexive if for all $a \in A$, $(a, a) \notin R$. If $|A| = n \geq 1$, how many different relations on A are neither reflexive nor irreflexive?　10%