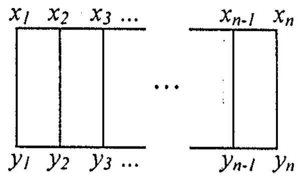
1. Let $G = (V, E)$ be the undirected connected "ladder graph" shown in the following. For $n \geq 0$, let a_n denote the number of ways one can select n of the edges in G so that no two edges share a common vertex. Find and solve a recurrence relation for a_n. (15%)



2. Construct a minimum-state Mealy style finite-state machine that delays an input string two bits, given *00* as the first two bits of output. (20%)

3. What is the cycle index of the group of rigid motions on 3*3 tick-tack-toe configurations? What is the number of different configurations among the 3*3 tick-tack-toe configurations with 5 crosses and 4 naughts? Such a configuration is shown in the following. (15%)

×	×	×
o	×	×
o	o	o

4. Prove
(a) If $T(n)=2T(n/2)+cn$, where c is a constant, then $T(n)=O(n\log n)$, (10%)
(b) If $T(n)=T(0.75n)+cn$, where c is a constant, then $T(n)=O(n)$. (10%)

5. Show that a connected graph G is an Euler graph if and only if it can be decomposed into circuits. *(A closed walk in which no vertex (except the initial and the final vertex) appears more than once is called a* ***circuit****. If there exists a closed walk in a graph which contains all the edges of the graph, then this graph is called an* ***Euler graph****)* (15%)

(背面仍有題目,請繼續作答)

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6. Refer to the following three-state finite state machine with (15%)

$p(a/a)=1/3$， $p(b/a)=1/3$， $p(c/a)=1/3$，
$p(a/b)=1/4$， $p(b/b)=1/2$， $p(c/b)=1/4$，
$p(a/c)=1/4$， $P(b/c)=1/4$， $p(c/c)=1/2$。

Then, p_a=? p_b=? p_c=?