

## MATH 454 PRACTICE MID-TERM

(Midterm I: Oct. 17, 2005)

**Question 1.** How many words of five letters do not contain any single letter more than twice?

**Question 2.** What is the probability that an RNA strand consisting of 6 A's, 5 C's, 4 G's and 1 U will contain two adjacent occurrences of A?

**Question 3.** Let  $G$  be the graph obtained by pasting together two copies of  $Z_4$  as shown:



Show (prove) that  $P(G, x) = P(Z_4, x)^2/x$ .

**Question 4.** Find a graph whose chromatic polynomial is  $x^2(x-1)(x-2)^2$ .

**Question 5.** What is the minimum possible number  $n$  of vertices for a tree  $T$  which has four vertices of degree 3, and three vertices of degree 4?

How many such trees are there, if the vertex set is fixed ( $V = \{1, \dots, n\}$ )?

**Question 6.** If  $G$  is a graph and  $k = \chi(G)$  is its chromatic number, show (prove) that  $P(G, k)$  is divisible by  $k!$ .