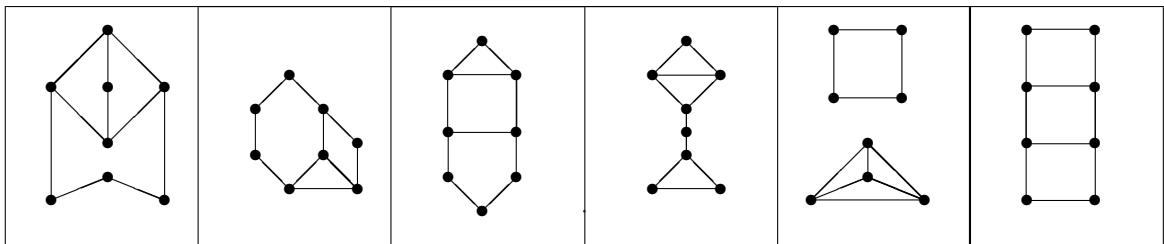


# Math105 Test 4: Counting, Relations and Graphs

December 2, 2005

1. Determine each of these parameters for these graphs, giving reasons:

(i) Connectedness (ii) Chromatic Number (iii) Valency sequence of the subgraph of the graph formed by deleting the vertices of valency 3. Determine which of the above graphs  $G$  is isomorphic to if  $E(G) := \{ag, ah, be, bf, ce, cg, ch, df, dg, eh\}$ .



2. At a veterinary clinic during one day there were 6 dogs, 4 cats, 2 rabbits and an iguana to be treated by one particular vet. Explain why you are using the particular counting method you are using, how your numbers came about and give two examples of the things you are counting in each case.

- Differentiating between the animals of the same species, in how many ways could the last two animals waiting to be seen have been?
- How many sequences can the first three animals which were not dogs have been treated?
- Considering just the species now, how many different orders could there have been for the first four animals?

3. Given these relations from  $\{u, v, w, x, y, z\}$  to itself determine which are everywhere defined, which are onto, and whether they are symmetric, anti-symmetric or neither.

$$P := \{(u, x), (w, x), (y, u), (y, v), (y, z), (w, u), (y, x)\}$$

$$Q := \{(u, w), (w, x), (x, z), (z, u), (v, z), (v, w), (y, y)\}$$

$$R := \{(y, x), (z, w), (u, u), (v, z), (w, v), (x, y)\}$$

One is a permutation, one is a function and one is a partial order; identify which, establishing that type of relation's particular criteria all exist.