# Math205 Test 1

September 2010

Answer all questions and give complete reasons and checks for your answers. The parts of the questions are weighted as shown and the questions can be answered in any order. Please do not erase any working and hand in your rough work too.

1. The universal set $\mathcal{U}$ is made up of these 13 dominoes; each domino is made up of two squares and contains between zero and six dots:
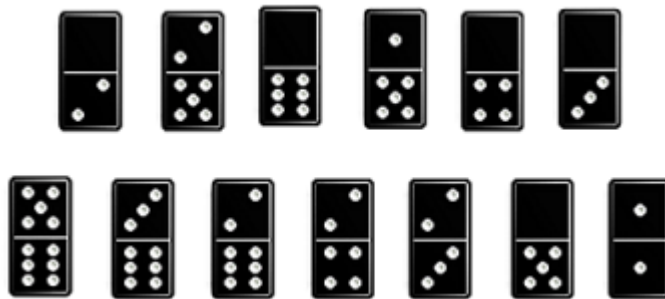
   (a) Determine the contents of these three subsets of $\mathcal{U}$, giving your reasons, and draw a Venn diagram of the three sets: R is the set of dominoes which have a difference between the number of the dots on their two squares of at least 3. S is the set of dominoes which contain a blank square or a single dot square. T is the set of dominoes from $\mathcal{U}$ which has a total number of dots which is even. [5]

   (b) Identify the region in your Venn diagram which is empty and give a name of a subset of your diagram which has cardinality 4. Give a domino which is not in $\mathcal{U}$ which would be in your empty set, explaining why. [4]

   (c) Verify the inclusion-exclusion formula for $|R \cup S \cup T|$. [2]

2. (a) Simplify this expression using set algebra. [6]
$$E^c \cap ((A^c \cup (B \cap E)) \cap B)$$

   (b) Use Venn diagrams to show that [3]
$$(X \cap Y) \subseteq ((Z \cap X) \cup (Y \cap Z^c))$$