Math2101 Test 1 (January 2019)

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

1. Show that $\triangle$ is not distributive over $\cup$ using Venn diagrams to build $X \triangle (Y \cup Z)$ and $(X \triangle Y) \cup (X \triangle Z)$. Compare the final Venn diagrams; is one a subset of the other? [4]

2. This question's universal set $\mathcal{U}$ contains the following 12 CBU course codes:

   CHEM1104   PHYS1104   CHEM1105   MATH1114   MATH1116   PHYS1204
   MATH1206   CHEM1401   MATH2101   MGSC2104   BIOL2211   ENGL3685

   (a) I will describe three subsets of $\mathcal{U}$, please determine their members, indicating what about each course code shows each is in the subsets or not, and carefully draw a Venn diagram of all three sets together: [4]

   - F:= { Course codes which end in the digit 4}
   - G:= { Course codes which begin with the letter M}
   - H:={ Course codes which do not contain the digit 0}

   (b) Define $J := H \cap (G \cup \overline{F})$. Remember to ask me for help if you can't get information needed for any of the subsequent steps of this question.

      i. Shade in J in a new copy of the Venn diagram for F, G and H. [1]
      ii. Identify the elements from (a) which are in J and hence determine $|J|$. [2]
      iii. Explain why $H \subseteq J$ with the universal set from (a). [1]
      iv. Express $H \setminus J$ as a sub-region in terms of the intersection of F, G and H, or their complements as necessary. [1]

3. Using the rules of set algebra, specifying which rules are used at each step, simplify this set as far as possible: [7]

$$B \cap ((\overline{B} \cap C) \cup A)$$