

This homework runs from 3pm Thursday 5 October 2023 until 12 noon on Thursday 12 October 2023. Submission is to Gradescope Homework 3.

### Question 1

For two sets  $A$  and  $B$  their *symmetric difference*  $\Delta$  can be described as the set of all elements from  $A$  and  $B$  that are not in the intersection of  $A$  and  $B$ . We write that as follows.

$$(A \cup B) - (A \cap B) \quad (1)$$

There following is an alternate description proposed for the same set  $\Delta$ .

$$(A - B) \cup (B - A) \quad (2)$$

- (a) Describe the set (2) in words, as was done earlier for the expression (1). [1 mark]
- (b) Construct an algebraic proof that the two expressions (1) and (2) are equivalent. You can use any of the set identities listed in Theorem 6.2.2 of the Epp textbook. Make it clear which identity you are using at each stage in the proof. [5 marks]

### Question 2

Suppose that  $J$  and  $K$  are subsets of  $\mathbb{Z}$ , the set of integers, with  $12 \in K$  and  $f : J \rightarrow K$  some (total) function. For each of the following situations say how many elements of  $J$  could be related by function  $f$  to the value 12.

- (a) Function  $f$  is one-to-one (injective).
- (b) Function  $f$  is onto (surjective).
- (c) Function  $f$  is bijective.

In which of these cases can we be sure that  $f$  has a unique inverse function  $f^{-1}$  that is defined everywhere on  $K$ ? [4 marks]