

Name

Student number

[5] 1. Prove (I suggest indirectly, that is, by deducing a contradiction from the assumption that the proposition is false) that if a connected graph with  $n$  vertices has more than  $n - 1$  edges then it has a cycle.

[10] 2. (a) Use the iterative algorithm BUILDTREE to construct a tree for ordering in their usual numerical order the following numbers: 999, 502, 618, 555, 606, 599. Deal with the input in the given order. Only the labelled tree needs to be recorded in your answer.

(b) Perform the recursive post-order sort algorithm on the tree of part (a) and record the resulting order.

[13] 3. (a) How many ways can  $n$  persons be sorted into two disjoint committees and a leftover group when the committees can't be empty but the leftover group can?

(b) What does the expression of part (a) increase to if the committees can overlap?

(c) Check for  $n = 3$  that your calculations in parts (a) and (b) are correct.

[7] 4. (a) Write out the group table for  $\sigma(2)$ , choosing symbols for the elements of the group.

(b) Write out the group table for  $\sigma(2) \times \sigma(2)$  using the symbols chosen in part (a).