Decision Mathematics 1 - Algorithms

June 2008 – Question 1 – 7 Marks

This question is about using bubble sort to sort a list of numbers into **increasing** order.

(i) Which numbers, if any, can be guaranteed to be in their correct final position after the first pass? [1]

Suppose now that the original, unsorted list was 3, 2, 1, 5, 4.

(ii) Write down the list that results after one pass through bubble sort. How many comparisons and how many swaps were used in this pass? [2]

(iii) Write down the list that results after a second pass through bubble sort. How many more passes will be required until the algorithm terminates? [2]

Bubble sort is a quadratic order algorithm.

(iv) A computer takes 0.2 seconds to sort a list of 500 numbers using bubble sort. Approximately how long will it take to sort a list of 3000 numbers? [2]

January 2008 – Question 1 – 6 Marks

Five boxes weigh $5\,\text{kg}$, $2\,\text{kg}$, $4\,\text{kg}$, $3\,\text{kg}$ and $8\,\text{kg}$. They are stacked, in the order given, with the first box at the top of the stack. The boxes are to be packed into bins that can each hold up to $10\,\text{kg}$.

(i) Use the first-fit method to put the boxes into bins. Show clearly which boxes are packed in which bins. [2]

(ii) Use the first-fit decreasing method to put the boxes into bins. You do not need to use an algorithm for sorting. Show clearly which boxes are packed in which bins. [2]

(iii) Why might the first-fit decreasing method not be practical? [1]

(iv) Show that if the bins can only hold up to $8\,\text{kg}$ each it is still possible to pack the boxes into three bins. [1]

Specimen Paper – Question 3 – 8 Marks

(i) Use the shuttle sort algorithm to sort the list

$$6 \quad 3 \quad 8 \quad 3 \quad 2$$

into increasing order. Write down the list that results from each pass through the algorithm. [5]

(ii) Shuttle sort is a quadratic order algorithm. Explain briefly what this statement means. [3]

January 2007 – Question 1 – 7 Marks

An airline allows each passenger to carry a maximum of 25 kg in luggage. The four members of the Adams family have bags of the following weights (to the nearest kg):

Mr Adams:	10	4	2			
Mrs Adams:	13	3	7	5	2	4
Sarah Adams:	5	8	2	5		
Tim Adams:	10	5	3	5	3	

The bags need to be grouped into bundles of 25 kg maximum so that each member of the family can carry a bundle of bags.

 (i) Use the first-fit method to group the bags into bundles of 25 kg maximum. Start with the bags belonging to Mr Adams, then those of Mrs Adams, followed by Sarah and finally Tim. [3]

 (ii) Use the first-fit decreasing method to group the same bags into bundles of 25 kg maximum. [3]

 (iii) Suggest a reason why the grouping of the bags in part (i) might be easier for the family to carry. [1]