MATH3202/7232 Operations Research & Mathematical Planning 2014

Practical Exam

Do not open this exam paper until instructed to do so.

Time allowed: **90** minutes

There are **2** questions on this exam for a total of **10** marks

You may access any material during the exam including material on paper, in your electronic files or online. However you may not communicate with other people during the exam.

Submit your Python files for each question through Blackboard before the end of the exam.

Please fill in your details below.

Student number: .....

Name: .....

Signature: .....

Question 1 *(6 marks)*

Consider the following word game. You are assigned a number of tiles, each containing a letter $a, b, \ldots,$ or z from the alphabet. For any letter from the alphabet, your assignment includes N_α tiles with the letter α (the list **N** in the python stub). You also have a number of blank letters ($NBlanks = 50$ in the Python stub). From the letters you are to construct some of the words from a list of words $w_1, w_2, \ldots, w_m$. This list might, for example, contain all words from a given dictionary.

You may construct any word at most once, and use any tile at most once, including each blank tile used at most once. You receive v_j points (the list **v** in the python stub) for making word w_j.

Formulate the problem of selecting the highest scoring set of words as an integer programming problem. Write the formulation in the space below. *Hint: If you are having difficulty with the blank tiles, formulate and solve the problem without these tiles and then see if you can work out how to modify your formulation.*

Implement your solution in Python and use it to find the optimal solution. You will need to download the stub file **words.py** and the word list **freqs.txt**. Write down the best score, and which letters the blanks are used to represent, in the space below (or on the back of this sheet if needed).

Question 2 *(4 marks)*

A shopkeeper wishes to plan the purchase of a particular item for the next six months. Suppose that the demand in these months must be met exactly and is known in advance to be as follows:

Month	0	1	2	3	4	5
Demand	10	20	30	30	20	20

The shopkeeper orders at the beginning of each month and initially she has no units of the item. Any units left at the end of a month will be transferred to the next month, but at a cost of $0.10 per unit. She attempts to stock whatever remains but cannot stock more than 40 units – units in excess of 40 are discarded at no additional cost and with no salvage value.

It costs $20 to place an order (regardless of size) plus $2 per unit. Assume that the retailer can order only in lots of 10, 20, . . . units and that the maximum amount she can order each month is 60 units. Further assume that she receives the order immediately (no lead time) and that the demand occurs just after she receives the order. How many units should the shopkeeper order each month?

Implement a dynamic programming formulation in Python, including comments in your code that describe the stages, state variable and value function. Write the optimal solution in the space below.