THE UNIVERSITY OF QUEENSLAND
AUSTRALIA

This exam paper must not be removed from the venue

Venue _____

Seat Number _____

Student Number |__|__|__|__|__|__|__|__|

Family Name _____

First Name _____

School of Mathematics & Physics

EXAMINATION

Semester One Final Examinations, 2018

MATH7232 Operations Research and Mathematical Planning (Practical Exam)

This paper is for St Lucia Campus students.

Examination Duration: 120 minutes

Reading Time: 10 minutes

Exam Conditions:

This is a School Examination

This is an Open Book Examination

During reading time - write only on the rough paper provided

This examination paper will be released to the Library

Materials Permitted In The Exam Venue:

(No electronic aids are permitted e.g. laptops, phones)

None

Materials To Be Supplied To Students:

None

Instructions To Students:

There are **20** marks available on this exam from **2** questions.

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.

For Examiner Use Only

Question	Mark

Total _____

Question 1 – Integer Programming

12 marks total

A severe storm is approaching Moreton Bay and there are currently 18 boats still out on the water. Each boat can seek shelter in the ports at Manly, Cleveland or Dunwich. The data in the Python stub gives the time (in minutes) that it will take each boat to make it to each port. Manly and Cleveland each have capacity remaining for 8 boats while the smaller Dunwich port can only accommodate 6 boats.

a) Which port should each boat be sent to in order to minimise the total travel time for the 18 boats? Formulate this as an integer programming problem. Write the formulation in the space below. Implement your formulation in Python. *[8 marks]*

b) Minimising the total travel time may still leave some boats out when the storm arrives. Suppose instead we want to minimise the *maximum* travel time for all 18 boats. Revise your formulation and show the new variables, objective and constraints in the space below. Implement your revised formulation in Python. *[4 marks]*

Question 2 – Dynamic Programming

8 marks

You are about to play 10 rounds of the Iterated Prisoner's Dilemma with an opponent who initially has a 0.6 probability of cooperating. Every round you cooperate, their probability of cooperating increases by 0.1 (to a maximum of 1). However, every round you defect, their probability of cooperating decreases by 0.2 (to a minimum of 0).

The payoffs for you are given by the following table:

		Opponent	
		Cooperate	Defect
You	Cooperate	3	0
	Defect	5	1

What strategy should you pursue to maximise your expected payoff from the 10 plays? Implement a dynamic programming formulation of this problem in Python. Include comments in your code that describe the stages, state, actions and value function. Write the optimal strategy in the space below.

END OF EXAMINATION