



Semester II Examinations 2019/2020
PRACTICE EXAM – NOT EMBARGOED

Exam Code(s)	1MAI1
Exam(s)	MSc in Computer Science (Artificial Intelligence)
Module Code(s)	CT5141
Module(s)	Optimisation
Paper No.	1
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Internal Examiner(s)	Prof. Michael Madden Dr. James McDermott *
Programme Coordinator(s)	Dr. Michael Schukat

Instructions

Answer any 4 questions. All are worth equal marks.

Answer in a Word document or similar and upload to Blackboard. CT5141_Optimisation_Practice_Exam_Answer_Sheet.docx is suggested.

Your submission must include the Student Statement on Academic Integrity as in that file.

This is an **open-book** exam: you may use textbooks, notes, and **existing resources** on the internet.

You may **not communicate** with anyone, in person, via phone, internet, or otherwise. You may **not post questions** on internet sites or elsewhere during the exam.

Duration

30 minutes plus 5 minutes for upload. You should stop writing, save and exit your word processor after 30 minutes.

Question 1: Various Topics

- (a) Given these two parent bitstrings, demonstrate how the *two-point* crossover works, by showing two possible pairs of offspring. [5]

00000000
11111111

- (b) Complete the following Python implementation of the two-point crossover, where `p1` and `p2` are parent bitstrings represented as Python lists. It should return two offspring as Python lists. [5]

```
import random
def cross(p1, p2):
    # YOUR CODE HERE
```

- (c) For a problem with binary decision variables, why does an *estimation of distribution algorithm* store *real* values instead of binary? Answer in your own words. [5]
- (d) (From Topcu and Babak, modified.) Bevco manufactures an orange flavored soft drink called Oranj by combining orange soda and orange juice, and nothing else. Each ounce (abbreviated oz) of orange soda contains 0.5 oz of sugar and 1 mg of vitamin C. Each ounce of orange juice contains 0.25 oz of sugar and 3 mg of vitamin C. It costs Bevco 2 cents to produce an ounce of orange soda and 3 cents to produce an ounce of orange juice. The marketing department has decided that each 10 oz bottle of Oranj must contain *at least* 20 mg of vitamin C and *at most* 4 oz of sugar. We wish to meet the marketing department's requirements at minimum cost. *Formulate this as an LP problem.* [5]
- (e) A partial Bevco solution is shown below. Say which constraints are binding and why. [5]

