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Diploma Programme
Programme du diplôme
Programa del Diploma

Computer science
Higher level
Paper 3

Monday 31 October 2022 (morning)

1 hour

Instructions to candidates

- Do not turn over this examination paper until instructed to do so.
- A clean copy of the **computer science case study** is required for this examination paper.
- Read the case study carefully.
- Answer all questions.
- The maximum mark for this examination paper is **[30 marks]**.

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2 pages

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Answer **all** questions.

1. (a) Outline why combinatorial optimization is used in the travelling salesman problem. [2]

(b) Outline **one** potential problem with hill climbing when applied to the travelling salesman problem. [2]

2. (a) An annual cycling race is scheduled to take place between 20 cities. The race starts and finishes in the same city. All other cities on the route are visited only once. Each day, competitors race between two cities on the route.

Each year, the organizers of the race plan a new route. However, an independent cycling organization has suggested that a genetic algorithm could be used instead. This has several social and ethical implications.

Compare and contrast the suitability of using a genetic algorithm to plan the route against the race organizers planning the route. [4]

(b) After several generations of selection followed by order crossover (OX), the parent routes between eight cities have become similar:

P1	B	A	G	C	J	D	H	E	F	I

P2	I	A	G	C	J	D	H	E	F	B

Explain why mutation would be introduced into this example. [4]

3. Two selection methods that could be applied to the travelling salesman problem are roulette wheel selection and tournament selection.

Evaluate these two selection methods. [6]

4. The case study states: “Successful implementations of genetic algorithms strike a natural balance between exploration and exploitation, and techniques such as simulated annealing can fine-tune that balance as the algorithm progresses towards convergence” (page 7, Discussion).

Discuss the role of convergence in genetic algorithms and how exploration and exploitation can affect its success. [12]

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