Diploma Programme
Programme du diplôme
Programa del Diploma

Computer science
Higher level
Paper 3

6 May 2024

Zone A morning | **Zone B** morning | **Zone C** 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]**.

2224 – 6916

2 pages

Answer **all** questions.

1. (a) Define the term *computer vision*. [2]

(b) Describe how the processor in a rescue robot would use an odometry sensor to determine how far the robot has travelled. [2]

2. (a) Pose estimation can be used to describe the configuration of human body parts in order to carry out rescue operations.

Describe the difficulties of pose estimation when there is object occlusion. [4]

(b) Edge computing is an approach that provides computation and data storage.

Explain why edge computing might be used with rescue robots. [4]

3. Rescue operations in disaster situations face many ethical challenges. This is further complicated by the use of rescue robots and machine learning. One ethical standard is fairness and non-discrimination.

Robots use machine learning algorithms to make decisions about the order that casualties are rescued. A form of bias may occur deliberately or inadvertently: the programmer may have made a conscious choice, or the machine learning algorithm may be making its own decision.

Explain the concerns about fairness and non-discrimination when programming a robot that decides which casualty to rescue first. [6]

4. vSLAM algorithms are designed to operate in GPS-denied or GPS-degraded environments. Rescue teams in these environments cannot rely on GPS tracking.

BotPro wants your opinion on whether rescue robots installed with vSLAM algorithms will be effective when looking for injured or unconscious people in an emergency situation, such as a factory fire. Such emergencies are time critical.

Evaluate the effectiveness of robots that use vSLAM algorithms to find casualties in an appropriate timeframe. [12]