Diploma Programme
Programme du diplôme
Programa del Diploma

Computer science
Higher level
Paper 3

Monday 5 November 2018 (morning)

1 hour

Instructions to candidates

- Do not open 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]**.

3 pages

International Baccalaureate
Baccalauréat International
Bachillerato Internacional

Answer **all** questions.

1.   (a)   State the requirements for an autonomous vehicle to be classed at Level 5 on the
             Society of Automotive Engineers' (SAE) scale for autonomous driving.   [2]

      (b)   Define *max-pooling*.   [2]

2.   (a)   Outline the reasons for the inclusion of both GPS and high density mapping in
             autonomous car systems.   [4]

      (b)   In the case study Sven states that "…human error contributes to 90 % of all traffic
             accidents." He also points out that beta-testing of autonomous car systems are being
             carried out on public roads.

   Evaluate, from an ethical point of view, the decision taken by manufacturers to carry
             out the beta-testing of autonomous vehicles on public roads.   [4]

3.   The convolutional layer in convolutional neural networks makes use of filters to produce a
      series of feature maps. Each of these feature maps will identify the presence of a specific
      feature if it appears anywhere in the image.

      Explain the processing that is carried out in the convolutional layer which allows this to happen. [6]

4.   Two initiatives in the *Levangerstadt* plans are the bus and the taxi projects.

      The diagram below shows a subset of the town's intersections and the distances between
      them. Taxis will make use Dijkstra's algorithm to calculate the shortest route between two
      points (intersections) and buses will make use of the nearest-neighbour algorithm to plot a
      route that will link any combination of points.
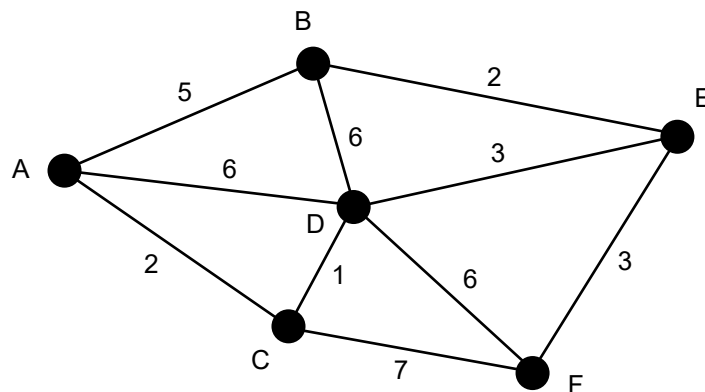
      The autonomous vehicles used for these two projects must not only be able to safely
      navigate the chosen routes but also be able to respond to any temporary changes in the
      environment.

      In the case study Sven emphasized that they were creating a completely new environment
      using the latest technology available.

(This question continues on the following page)

(Question 4 continued)

By focusing on the relevant technologies, protocols and path-finding algorithms, discuss how the unique characteristics of this project will contribute to its chances of success. You should make reference to the computer science identified in this case study.

Note: there is no need to calculate specific routes, but the diagram can be used to illustrate any points in your discussion.   [12]