COMP34212

Two hours - online

EXAM PAPER MUST NOT BE REMOVED FROM THE EXAM ROOM

UNIVERSITY OF MANCHESTER
DEPARTMENT OF COMPUTER SCIENCE

Cognitive Robotics

Date:

Time:

This is an online examination. Please answer ALL Questions
The examination is worth a total of 70 marks
The exam contains MULTIPLE CHOICE QUESTIONS

This is a CLOSED book examination

The use of electronic calculators is NOT permitted

[PTO]

Section A

This section is multiple choice. Each correct questions gives 2 marks.
Answer ALL questions from this section.
There is only one correct answer per question.
Write your answer directly into the box provided for each question.

1. Which of the robots below is an android robot? (Knowledge)

 A	 B	 C	 D

☐

2. What is the difference between developmental and evolutionary robotics? (Comprehension)

A. Developmental robotics models genetic phenomena, and evolutionary robotics models learning phenomena.
B. Developmental robotics models genetic phenomena, and evolutionary robotics models epigenetic phenomena.
C. Developmental robotics models ontogenetic phenomena, and evolutionary robotics models phylogenetic phenomena.
D Developmental robotics models phylogenetic phenomena, and evolutionary robotics models ontogenetic phenomena.

☐

3. Which of the following pairs refer to robotics middleware? (Methods)

A. ROS and YARP
B. iCub and Erica
C. Microphone and automatic speech recognition system
D Sensors and actuators

4. What is "Morphological Computation"? (Knowledge)

A. Exploitation of the body morphology for effective actuation
B. Exploitation of the environment morphology for effective actuation
C. Exploitation of the body-environment interaction for effective actuation
D Exploitation of energy-efficient batteries for effective actuation

5. How many Degrees of Freedom does a human arm have (not including the hand) ? (Knowledge)

A. 3
B. 5
C. 7
D 9

6. How can transfer learning be applied to deep networks for robotics? (Methods)

A. To transfer the learning experience from a deep network to other machine learning method
B. To transfer the learning via embodied language
C. To use the learned parameters for another task
D To use the learned parameters for another machine learning method

7. What is "Closed Loop Control" in robotics ? (Application)

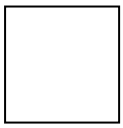
A. The application of a predefined force to robot joints towards the desired state
B. Feedforward control
C. Feedback control
D The application of a closed circuit to robot joints

8. What is the "Uncanny Valley" phenomenon ? (Knowledge)

A. Drop in robot's reaction and affinity to the view of a human
B. Drop in human's reaction and affinity to the view of a legged robot
C. Drop in human's reaction and affinity to the view of a humanoid robot
D Drop in human's reaction and affinity to the view of an android robot

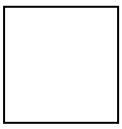
9. What is the LIDAR sensor used for ? (Application)

A. For navigation
B. For grasping
C. For speaking
D For listening



10. What is an ethical machine ? (Ethics)

A. A machine guided by a person in deciding how to act in a given situation
B. A machine guided by a country's legal ethical rules in deciding how to act in a given situation
C. A machine guided by the human designer's ethical rules in deciding how to act in a given situation
D A machine guided by intrinsic ethical rules in deciding how to act in a given situation



Section B

11. Cognitive developmental robotics (Knowledge/Methods/Applications) **[30 marks total]**

a) Give a definition of "Cognitive Robotics" and "Intelligent Robotics" and explain the key differences between them. [4 marks]

b) Explain what "Developmental Robotics" is, and how psychology informs the design of developmental robotics models [4 marks]

c) Analyse the characteristics of two of the six key principles in developmental robotics [6 marks]

d) Choose one example to developmental robotics model (e.g. for manipulation or social skills or language or other behaviour). For this sample model, explain the following:

i) what is the aim of the developmental robotics model and which is the psychology study that inspires the robotics model [4 marks]

ii) the AI and learning algorithm(s) used to realise the robotics model [6 marks]

iii) the experimental task used to validate the model [3 marks]

iv) a sample result highlighting the benefits of using the developmental approach. [3 marks]

12. Ethics for AI and Robotics (Comprehension/Ethics) **[20 marks total]**

a) Discuss some key potential ethical issues and harms of AI and robotics [4 marks]

b) Discuss one typical example of ethical harm caused by existing AI/robotics applications and how this can be addressed [4 marks]

c) Explain the main characteristics of two of the following philosophical ethics approaches: (i) Deontological ethics, (ii) Utilitarianism, (iii) Virtue ethics [4 marks]

d) Explain how AI Transparency and Explanatory Strategies can help developing ethical AI and discuss how these can be applied to a sample robotic application [8 marks]

END OF EXAMINATION