UNIVERSITY OF LINCOLN
UNITED KINGDOM

School of Computer Science

Time Constrained Assessment MOCK

Module Code	**CMP3103M**
Module Title	**Autonomous Mobile Robotics**
Module Coordinator	**Professor Marc Hanheide**
Duration of Assessment	**3 Hours**
Date	**MOCK**
Release Time	**?**
Submission Time	**?**
Total Wordlimit	**Around 200 words per question**

General Instructions to Candidates.

1. You **must** submit your answers as a MS Word Document to Turnitin on Blackboard **before** the submission time: failure to do so will be classified as misconduct in examinations. We strongly recommend you submit 15 minutes prior to the deadline.
2. You **must** also send a copy of your work to the socssubmssions@lincoln.ac.uk at the same time. You must place the Module Code and your Student Id in the Subject Field of the Mail.
3. Hand-written notes or diagrams **must** be photographed and inserted into the Word Document as an image.
4. This assessment is an open resource format: you may use online resources, lecture and seminar notes, textbooks and journals.
5. All work will be subject to plagiarism and academic integrity checks. In submitting your assessment, you are claiming that it is your own original work; if standard checks suggest otherwise, Academic Misconduct Regulations will be applied.
6. The duration of the Time Constrained Assessment will vary for those students with Learning Support Plans. Extensions do not apply, but Extenuating Circumstances can be applied for in the normal way.

Module Specific Instructions to Candidates

1. Please make sure you read each question carefully first.
2. Try to provide the answers directly in the assignment paper. Each question has a dedicated answer box you should use.
3. Answer each question precisely and concisely. You should not need more space than provided in the text boxes in this assignment paper. However, should you indeed need more space you may extend the text boxes to fit your answer, but usually that indicates you are writing too much. The indicated word limit is a limit, not a recommendation on how much you should write.
4. Please note that you will only receive marks for correct answers to the question, not for additional text you write. So, ensure to answer the question.

Question 1: Reactive Robot Behaviours [50 marks]

NOTE: THIS MOCK TCA CONTAINS 3 TOPIC AREAS TO SUPPORT YOUR REVISION, THE REAL ONE WILL FEATURE ONLY 2 TOPIC AREAS, WITH QUESTIONS OF 50 MARKS EACH.

a. [10 marks] Explain the concept of Braitenberg vehicles. Design and explain a Braitenberg vehicle that will be scared of light, assuming a robot with two light sensors and two wheels.

Answer here

b. [20 marks] Describe, in your own words, the difference between the "data pull" and "data push" communication models.

Explain which model is used in ROS and how communication between the components works.

Use an example of a "laser" node that returns distance readings from a laser scanner, and a "behaviour" node that receive this data to illustrate the processing (no need to write Python code, but please explain the processing, e.g. using pseudocode or a graphical representation).

Answer here

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c. [20 marks] Which sensor could you use to develop a wall-following robot, *[… this is about solving a specific use case, the question is not complete*]

Answer here

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Question 2: Navigation (50 marks)

a. *[… some basic question about navigation strategies, e.g. path integrations, dead-reckoning, also in biological systems. Discuss the limitations of such approaches and possible strategies for overcoming these limitations]* (12 marks)

Answer here

b. Describe the key features of topological and metric maps, and discuss the issues involved in building these different types of maps by an autonomous mobile robot (18 marks)

Answer here

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c. A mobile robot is equipped with odometry sensors (wheel encoders) and a forward-facing Kinect sensor, which is capable of providing both colour vision and depth information. Assume that the robot has already acquired an accurate and up-to-date 2D metric map of the environment using the same sensors and an appropriate mapping algorithm. The robot is deployed as a security patrol robot in an office environment consisting mainly of corridors, with many places that appear similar to the robot due to perceptual aliasing and the limitations of the robot's sensors. Your task is to describe an appropriate self-localisation algorithm for tracking the 2D pose of the robot during operation. Which state values will be estimated by your algorithm? (4 marks)

Answer here

d. *[another question on something else…]*

(16 marks).

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Question 3: Human Robot Interaction (50 marks)

a. Define embodiment, explicit interaction and implicit interaction between humans and these embodied machines. Explain explicit interaction and provide two specific examples for this type of interaction.
(12 marks)

Answer here

b. Considering both the computer science and social science point of view, list the pros and cons of using a 'Wizard of Oz' experiment versus an experiment with a fully autonomous robot. Give one example of a study where you would use 'Wizard of Oz', and another example of a study where you would use a fully or partially autonomous robot. For each example, explain why you would choose this approach. How would choosing the "wrong" modality influence the findings of your studies, and why? (18 marks)

Answer here

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c. *[… some question about a specific HRI sub-topic, e.g. proxemics or human-aware navigation, attention,…. Describe the concept, explain its specifics (models and implementation considerations), and its application in robotics?]* (20 marks)

Answer here

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