SAMPLE PAPER (date of this version: 9/2/2004)

UNIVERSITY OF EDINBURGH

COLLEGE OF SCIENCE AND ENGINEERING

SCHOOL OF INFORMATICS

INTRODUCTION TO VISION AND ROBOTICS

SAMPLE EXAM

Duration 1hr 30mins

INSTRUCTIONS TO CANDIDATES

Question 1 is compulsory.
Answer QUESTION 1 and ONE other question.

If you attempt three questions, cross out one answer; if you do not, then the examiners will cross out the last one you answered.

Each complete question carries equal weight and is marked out of 50. The parts of a question may not all be worth the same amount; the marks at the side of the questions indicate how these will normally be apportioned.

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1. Provide a short answer for each of the following questions. Each question is of equal weight.

   (a) What is meant by a 'technology domain'?

   (b) Sketch some different designs that might be used for a wheeled robot. Which are holonomic?

   (c) What do 'P' 'I' and 'D' stand for in PID control? Briefly explain the function of each.

   (d) What are 'degrees of freedom'?

   (e) What are some of the problems that can occur in image capture?

   (f) What is meant by a 'feature vector' in visual recognition?

   (g) Describe one method for extracting motion information from an image sequence.

   (h) How do gears modify the process characteristics of a motor?

2. (a) How can a robot avoid running into obstacles? [*10 marks*]

   (b) How can a robot use path integration and landmarks to keep track of its position in the world? [*25 marks*]

   (c) Give examples of how such a robot might use a) open-loop b) feed-forward c) feedback control to orient towards a landmark. [*15 marks*]

3. (a) Outline an algorithm that would allow a robot to recognise landmarks of different shapes while wandering around its world. [*25 marks*]

   (b) If your algorithm uses active vision, explain how. If not, describe how you might use active vision to improve the performance. [*10 marks*]

   (c) Define proprioception. How can vision be used as proprioception? What other kinds of propriocepive sensors are commonly used in robotics? [*15 marks*]