COMPUTER SCIENCE TRIPOS Part IB – 2012 – Paper 4

1 Artificial Intelligence I (SBH)

(a) You are designing an *informed search* algorithm to solve a problem of interest. Explain what a *heuristic function* is and why you might want to use one.

[2 marks]

(b) Define what it means for a heuristic function to be *admissible*, and explain why it might be desirable for such a function to have this property.   [3 marks]

(c) You have designed two possible heuristic functions h_1 and h_2, both of which you have shown to be admissible, and both of which are applicable to your problem. It has been suggested that you should try to combine them to make a more general heuristic function h defined as

$$h(s) = \alpha_1 h_1(s) + \alpha_2 h_2(s).$$

In this definition s denotes any state in the search problem, and the constants α_1 and α_2 are constrained such that they are non-negative and $\alpha_1 + \alpha_2 = 1$. Is the function h always admissible? Either prove that this is the case or provide a counterexample.   [8 marks]

(d) For a specific set of states $\{s_1, \ldots, s_n\}$ you have established that the *exact* corresponding distances to the goal are $\{d_1, \ldots, d_n\}$. You want to use this information to make a good choice of the parameters α_1 and α_2 in part (c). Derive an algorithm that allows you to do this. You may ignore the constraint requiring the parameters to be non-negative and sum to 1.   [7 marks]