COMS 4701 - Homework 1 - Written

**Harrison Groll 2136**

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**1** \*Question: PEAS and environments

Part 1: PEAS is an acronym which helps to define a rational agent. Such groupings are broken down by Performance, Environment, Actuators, and Sensors (PEAS). It is possible to consider the “FoldMe” robot through this lens. Attributes related to performance may include the device’s timing, its folding ability (i.e. were there wrinkles), and the extent of its folding capacity (i.e. performance across a range of clothing articles such as pants, shirts, towels, etc.), among others. Environments to be considered may include whether the device is to be used for personal use in a home (in which case the device should likely be able to handle a few dozen or so articles of clothing), versus a large-scale, industrial use environment such as a hotel cleaning services (in which case the device should likely be able to handle hundreds or thousands or articles of clothing at a time). Actuators to consider should be the robotic mechanisms to take the next article of clothing from the storage container, the mechanical arms to execute the folding, and the slot to move the folded item into a finished pile, among others. Lastly sensors needed for the device may include cameras needed to identity the type and shape of the clothing, among others.

Part 2: In addition to PEAS analysis, it is also helpful to discuss the environment types (namely: observability, number of agents, deterministic/stochastic, and discrete/continuous). With respect to the “FoldMe” robot, such device may be considered fully observable since the device’s sensors hives it access to the complete state environment at each point in time (i.e. no hidden aspects such opponents’ cards in the poker example). The environment is also deterministic in nature since each next state is completely determined by the current state and action executed by the agent (i.e. there is no uncertain outcomes modeled by probabilities such as an autonomous vehicle). Moreover, the environment is static since it is unchanged while the agent is deliberating. The environment is discrete since there exist a limited number of distinct, clearly defined percepts and action (i.e. item is either folded or not folded. The device should either fold item or pick up the next item to be folded, etc) .The environment is single agent (unless you have multiple folding machines communicating with each other!) since the agent is operating by itself in the environment. Lastly, the environment is largely unknown since the designer of the agent may not have knowledge about the environment makeup (the device may come across a wide array of clothing that it will need to fold, as such the exact environment makeup is unknown in some regards).

**2** \*Question: Search space formulation

Part 1: In order to represent each state, a collection can be used such as a list of the three peg objects. Each object can a three ‘slot’ elements which can map to a value of 0 if there is no item at that location, L if the large peg is at that location, M is the medium peg is at that location, or S if the small peg is at that location. This is one option to represent any given state. An example of the initial state is given:

state = [

{ # This Represents Peg 1 Elements

"upper\_slot": "S",

"middle\_slot": "M",

"bottom\_slot": "L"

}

,{ # Peg 2

" upper\_slot ": False,

" middle\_slot ": False,

" bottom\_slot ": False

}

,{ # Peg 3

" upper\_slot ": False,

" middle\_slot ": False,

" bottom\_slot ": False

}

]

Part 2: The initial state is one where all elements of peg 2 and 3 are empty/false, and peg one (i.e. state[0]) has an bottom slot of the large disk, a middle spot of the medium disk, and an upper slot of the small disk. One possible initial state representation using an array of objects is given above for part 1.

Part 3: Disregarding validity, the first disk can be in one of 9 slots, the second disk can be in one of 8 remaining slots, and the last disk can be in one of the 7 remaining slots. As such there are 9 \* 8 \* 7 (or 9P3) = 504 possible states.

Part 4: The possible actions include moving a disk the slot of one peg to the slot of another, however, an action much conform to the rules of the game whereby a disk cannot be on top of a smaller disk.

Part 5: The transition model is a description of what each action does. The transision model is the

**3** \*Question: Search strategies

**4** \*Question: Heuristics