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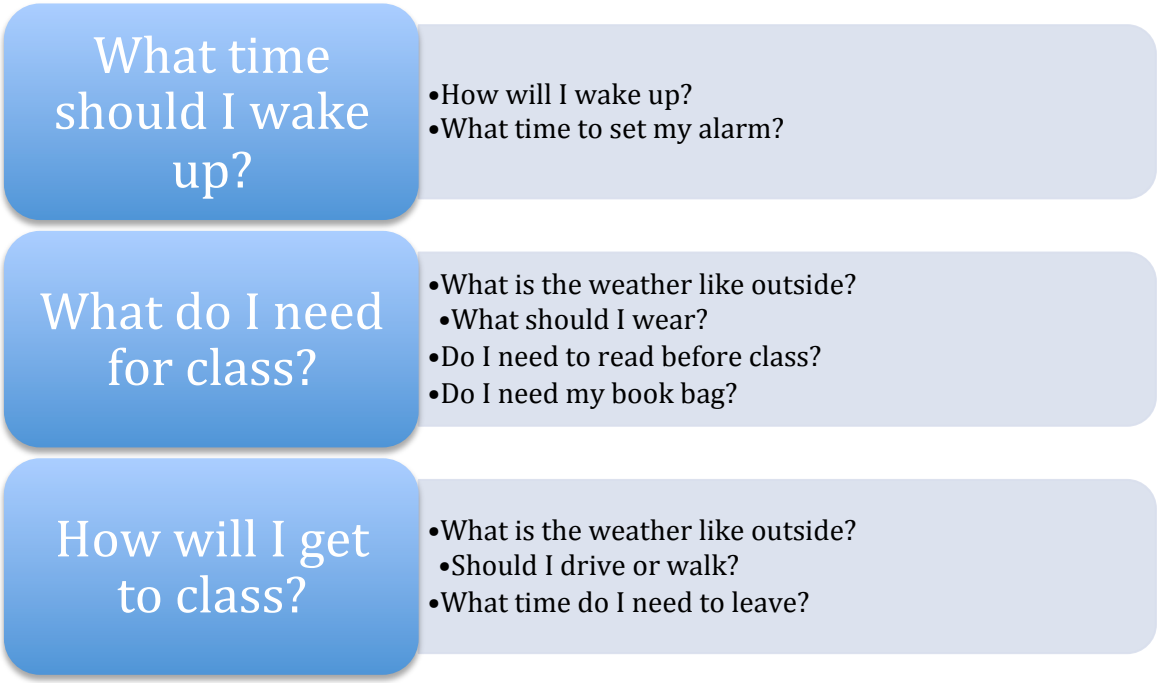
Assignment 8

Using Planning to solve Raven's progressive matrices

What is one of the most basic human instincts that occurs on a daily basis and almost associated with any action plan? I would argue that planning can fit this description. What's the first thing you do in the morning? Well, when I wake up, I immediately get dressed and start to think about what I need to accomplish for that day. Using these goals, I am immediately using Means-End Analysis to try and narrow down the state space of infinite possibilities to do with my day. So after identifying these goals, what am I going to do next to try and make sure they are completed. Plan. Planning is a natural way to decisively determine if a goal can be met, and what the optimal way to meet that includes. For example, what if I knew that I had to be at KBAI in Klaus at 9 am tomorrow? Immediately, I would start to plan in my head. What time should I wake up? How will I get to class? What should I bring? Do I need to prepare? To combat some of these questions, I made a planning diagram for the example problem to display the complexity of solving a problem such as going to class:

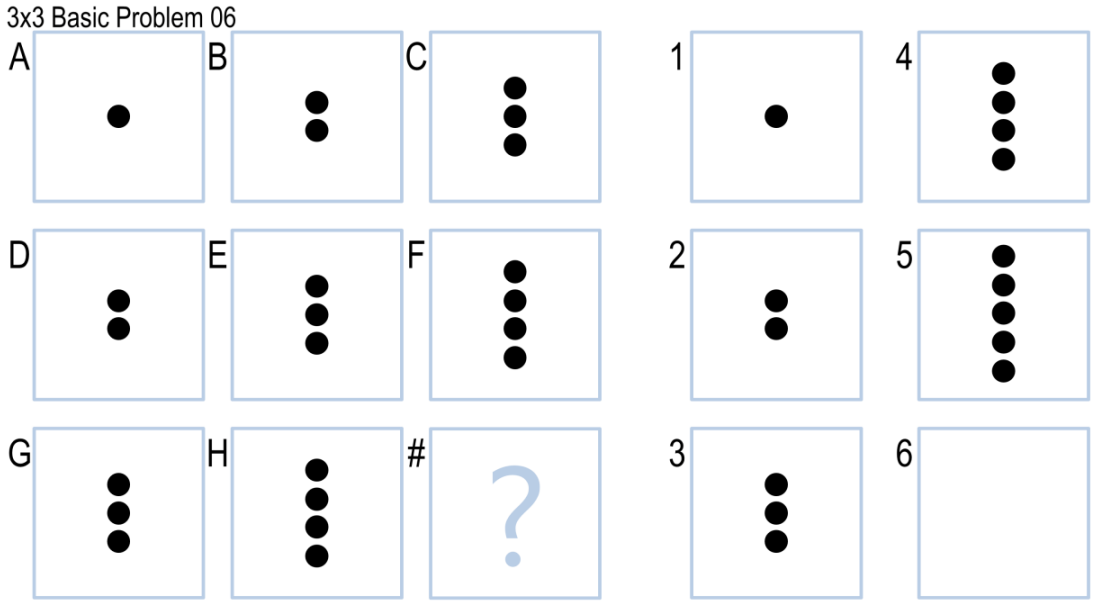


There are honestly many more questions that will need to be planned as well; for instance should I eat breakfast? Do I need coffee? Is my phone charged? Planning a small situation like this happens every day numerous times each day and is handled by everyone. Of course with Frames and Case-Based reasoning this doesn't have to

be solved each day because you can just simply index how you solved it last time. However, it does **at least** need to be solved once, the first day of class.

But how would an agent use planning to represent knowledge? Well in many search problems, agents that have access to the board can preprocess its moves so that it knows the most optimal path to the goal. This can be used in any type of game, where an agent is constantly reacting to a world with a purpose. After accessing the current goal, or even a variety of choices with a way to prioritize, the agent can then plan what needs to be done to reach that goal, or achieve the ideal scenario.

But how would an agent use planning to solve RPM? Well, planning could be viewed in a variety of ways for this problem. It could be viewed as a pre-processing step where the agent eliminates some of the possible answer choices based on heuristics. This is planning because the agent is considering the goal, of finding an answer, and then using the given figures to understand how to reach that goal. However, there is another way of our agent to plan for RPM problem. What if it viewed each of the figures as transformations of images, instead of text or semantic input? Then, it could apply transformations to each image. For this planning to occur, the agent could apply different transformations to the images per row and column to try and produce the desired result. It could perform this for each of the answer choices 1 – 6, and return the one that correlated with the same changes as the given figures, A – H. For example, look at this problem:



My agent could use planning for this problem by applying transformations from each of the given figures to the answer choices. It would then see that it needed an answer choice that had more objects than the one before it. It would then know as it

checked for this trait through each answer choice that only had this amount of objects. It would find that answer 5 is the only correct one.

Planning can be used in a variety of situations for artificial agents, even for RPM. It can become computationally expensive if the state space is massive, but because RPM has a finite amount of answer choices, the cost isn't that high. Planning is a natural problem solving method that intelligent beings have used for a variety of problems.