

Homework 1 (Summer 2020)

Answer the following prompts in a maximum of 10 pages (excluding references) [in JDF format](#). Any content beyond 10 pages will not be considered for a grade. 10 pages is a maximum, not a target; our recommended per-section lengths intentionally add to less than 10 pages. This length is intentionally set expecting that your submission may include diagrams, drawings, pictures, etc. These should be incorporated into the body of the paper.

If you would like to include additional information beyond the word limit, you may include it in clearly-marked appendices. These materials will not be used in grading your assignment, but they may help you get better feedback from your classmates and grader.

Question 1: ~2 pages

Rey has managed to capture Snoke and Kylo Ren on the planet Quesh. Quesh has a poisonous atmosphere, however, and so Rey, Snoke, and Kylo Ren will have to be kept together in quarantine for two weeks upon arriving back on the orbiting ship.

Only one shuttle is available to transfer individuals back and forth between Quesh and the orbiting ship, and that shuttle can only seat one person. The shuttle has an autopilot, though, so it can fly without anyone in it.

Leia, in the orbiting ship, refuses to let Rey be alone with Snoke (without Kylo) either on the planet or in quarantine, knowing that Snoke will turn Rey to the dark side. Snoke would rather stay and die than let Rey be alone with Kylo Ren, knowing that she will turn Kylo to the light side. Leia wants Snoke alive, and therefore agrees to his demand that Kylo and Rey never be alone together (without Snoke) either on the planet or in quarantine. It is okay, however, for Kylo & Rey or Rey & Snoke to be together if the shuttle is with them, as long as one of them departs on the shuttle.

In simple terms: the goal is to move Rey, Snoke, and Kylo from the planet to the ship. Only one can move at a time, and the shuttle can move without a passenger. Rey and Kylo can never be alone together without the shuttle, and Rey and Snoke can never be alone together without the shuttle. (If you are unfamiliar with Star Wars, know that this paragraph contains everything you need to know to solve this problem.)

First, **construct** a semantic network representing this problem. This should take approximately half a page, including a figure of two states with a transition between them. Make sure to include all components of the state, and an operator indicating how we transition from one state to another.

Second, **apply** generate & test to this semantic network in order to solve the problem. In applying generate & test, your generator should be smart enough to only make valid moves (e.g. it will not try to move two people at once or make consecutive planet-to-ship moves without the transport ship coming back), but it should not be smart enough to only make moves that result in valid states (e.g. it should still try to move Kylo first, even though that move results in an invalid state). Your tester, in turn, should check each generated state to see if (a) it follows the rules, and (b) if it has met the goal. You may decide whether identifying states that have already been visited is the responsibility of the generator or the tester.

Include the entire semantic network that solves this problem. Clearly indicate which states are failed, and why. The semantic network should explore the entire problem space: every state should be either ruled out or have its following states explored. We expect this will fit on one

page: you may create a more space-efficient representation if need be. As long as it is legible, you may also hand-write the network and insert it as an image into your paper.

Question 2: ~2 pages

Uno is a card game manufactured by Mattel and invented over 50 years ago; it is very similar to the game Crazy Eights played with a standard deck of cards.

A deck of Uno cards is made of 108 cards. Most cards are divided into four colors: there are 25 red cards, 25 yellow cards, 25 blue cards, and 25 green cards. Within each color are the numbers 0 through 9, and three special types of cards: Skip, Reverse, and Draw 2. There are also 8 black cards: 4 Wild cards and 4 Wild Draw 4 cards.

The rules of Uno are simple: between 2 and 10 players each receive 7 cards. The players then take turns putting down one card at a time on top of the Discard pile. The card that a player puts down must have either the same color or same number as the current card on top. So, if the top card is a red 7, then the next player can put down any red card or a 7 of any color. If a player has no other cards they can play, they may place a Wild card and select a new color for the next player to play. For example, if the top card is a red 7, then the current player could play a Wild card and say that the new color is Green. If a player has no cards that can be played, then they must draw a card; if they can play it, they may play it immediately, but otherwise play continues to the next player.

Some cards have special effects. A Skip card skips the next player's turn. A Reverse card reverses the order in which players play; if players were initially taking turns clockwise, they will now play counter-clockwise. A Draw 2 or Wild Draw 4 card requires the next player to draw the given number of cards instead of taking their turn.

The goal of the game is to get rid of all your cards. The first player to get rid of all their cards wins. Any time a player goes down to having only one card left, they must announce "Uno!" If another player says "Uno!" first, the player must draw 4 more cards. You can find a full rundown of the rules of Uno in [this PDF](#) (though you can ignore the parts about "500 points", those refer to a game made of multiple individual rounds of Uno—we're only talking about one round). You may practice playing against an AI at [this site](#).

After getting familiar with the rules of Uno and how to play, **write** a production system (that is, a series of if-then statements run in order on the agent's turn) for an agent that plays Uno.

Specifically, the production system should handle what the agent does when its turn comes up. The production system should handle (that is, select some legal move) for all scenarios it could encounter, including (a) having multiple cards available that could be played, (b) playing their second to last card, (c) having no cards that can be played, and (d) playing a Wild card and choosing a color. For full credit, your agent should also have some element of strategy; places where you might add some strategy could include how it chooses a color when playing a Wild card, how it considers how many cards other players have in selecting a card to play, or how it chooses from multiple potential cards that could be played. These decisions *could* be random, but your agent could also make those decisions strategically.

Then, **play** a round of Uno, using either the site above or your own set of cards. Play the game using your agent's production rules and **log** the game progress, including why your agent selects each action (for example, "The top card was a red 7. My agent selected to play a blue 7 because it selected the rule...").

Finally, briefly **reflect** on how your agent's production rules could be improved. What knowledge would be needed? How would that knowledge be implemented in your agent's structure?

Question 3: ~2 pages

Research the recently-passed General Data Protection Regulation passed by the European Union. **Describe** what the regulation says about the usage of personal data to personalize individual user experiences online. **Analyze** how that regulation might apply to the use of artificial intelligence to create personalized experiences.

Then, **select** an example of a device, company, or industry for which personalization is *deeply* embedded in its functional purpose or business model. Personalization should be deeply rooted in the purpose or model: Amazon, for example, uses personalized recommendations, but it is not difficult to imagine a user being able to specifically opt out of those recommendations and still use most of the service. Select a device, company, or industry for which, without personalization, there *is* no service.

Then, **evaluate** how these devices, sites, or services may be adapted to these GDPR restrictions. **Determine and defend** whether it is even possible to allow users in the European Economic Area to use these tools without waiving their GDPR rights.

Question 4: ~2 pages

In its [2011 appearance on Jeopardy](#), IBM's Watson competed against Ken Jennings and Brad Rutter, two of the show's all-time winningest contestants. In the two-round contest, Watson banked more money than Jennings and Rutter combined, \$77,147 to \$45,600 (\$24,000 for Jennings, \$21,600 for Rutter).

Based on this result, was Watson more intelligent than Jennings and Rutter? **Argue** either in favor of Watson being more intelligent than Jennings and Rutter, or in favor of Jennings and Rutter still being more intelligent than Watson. If you argue that Watson is more intelligent, make sure to address Jennings' and Rutter's superior performance on tasks against which Watson was not tested; if you argue Jennings and Rutter are more intelligent, make sure to address how Watson's performance on Jeopardy is insufficient in your view to make it more intelligent. Either way, your argument should be based on more than opinion; you should **provide** your working definition of intelligence, and **explain and explore** how Watson's, Rutter's, and Jennings' performance on Jeopardy relates to their intelligence according to your definition.