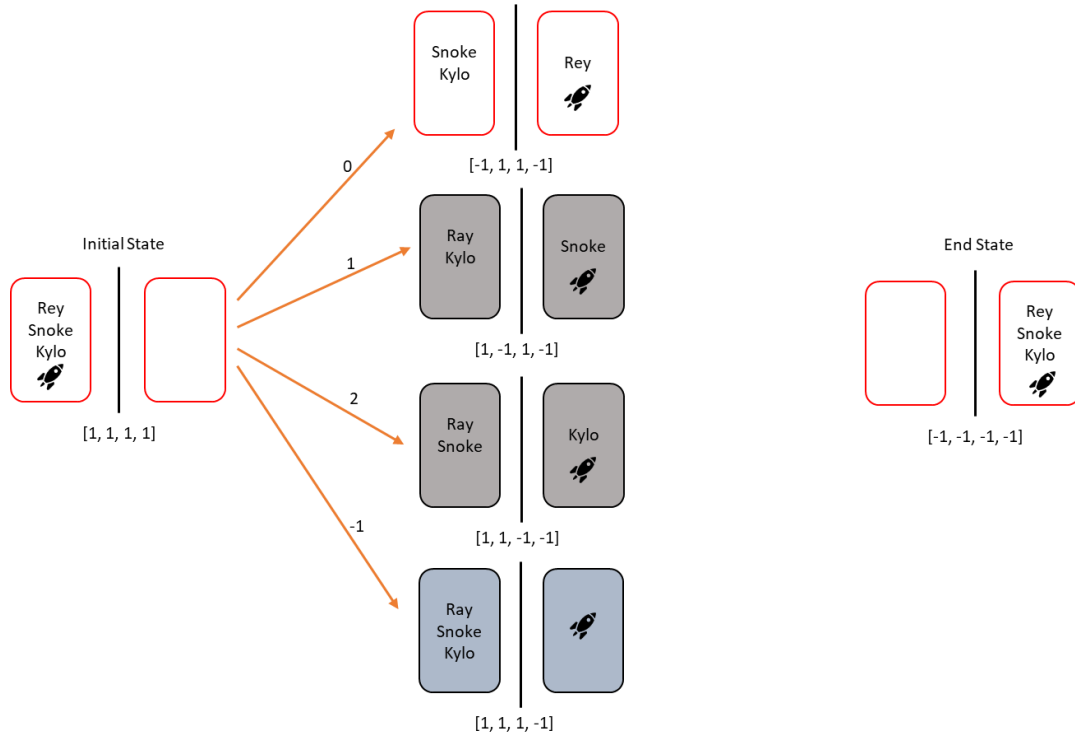


# Homework 1:

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## 1 QUESTION 1 – SENMATIC NETWORK STUDY

### 1.1 Construct the semantic network



*Figure 2*—The design of semantic network. Rectangle with red outline represents the valid state. Rectangle filled with grey color represents the invalid state due to the 1<sup>st</sup> constraint in section 1.2. Rectangle filled with blue color represents the invalid state due to the 2<sup>nd</sup> constraint in section 1.2.

Figure 1 above shows how the semantic network is designed. The state is represented by a list of 4 items. Rey is the 1<sup>st</sup> item, Snoke is the 2<sup>nd</sup>, Kylo is the 3<sup>rd</sup>, and the shuttle is the 4<sup>th</sup>. If a person or the shuttle is on the planet Quesh (left side in each state), it is represented by a positive 1. If it is on the orbiting ship, it is represented by a negative 1. The move is designed as integer because every time only one person is allowed to be on board. 0 means move Rey, 1 means Snoke and 2 means Kylo. For example, if the move equals to 1, the AI agent just

needs to swap the sign of state[1] and state[3] in the state list. Since the shuttle always travels, we don't have to specify its movement. If the shuttle is 1 in current state, it must be -1 in the next state and vice versa. Note that the shuttle can be moved without any person, an integer -1 of the move represents this situation.

Figure 1 above shows all possible movements with the initial state and all corresponding next states after each movement. Eventually, the end state should be [-1, -1, -1, -1] as everyone and the shuttle are on the right side. Theoretically, the state [-1, -1, -1, 1] is correct too. However, in order to get state [-1, -1, -1, 1], the state [-1, -1, -1, -1] has to be reached first and then move the shuttle back to the left. It is redundant, therefore the [-1, -1, -1, -1] is the only end state. More details of the figure design can be found in the figure title.

## 1.2 Apply generate & test

To meet the requirements and to make the travel more efficient, below constraints are applied to the states. If any move results in a state that hits below constraints, the move is not allowed:

1. Ray & Snoke or Ray & Kylo cannot be left alone on either side. Left alone means there is no other person nor the shuttle. Ray & Snoke & shuttle or Ray & Kylo & shuttle is allowed. As to the coding part, it means that
  - state[0] and state[1] cannot be the same sign when state[2] and state[3] are the opposite sign; and
  - state[0] and state[2] cannot be the same sign when state[1] and state[3] are the opposite sign

For example, in figure 1, move 1 and move 2 are not allowed because the next states conflict with this rule.

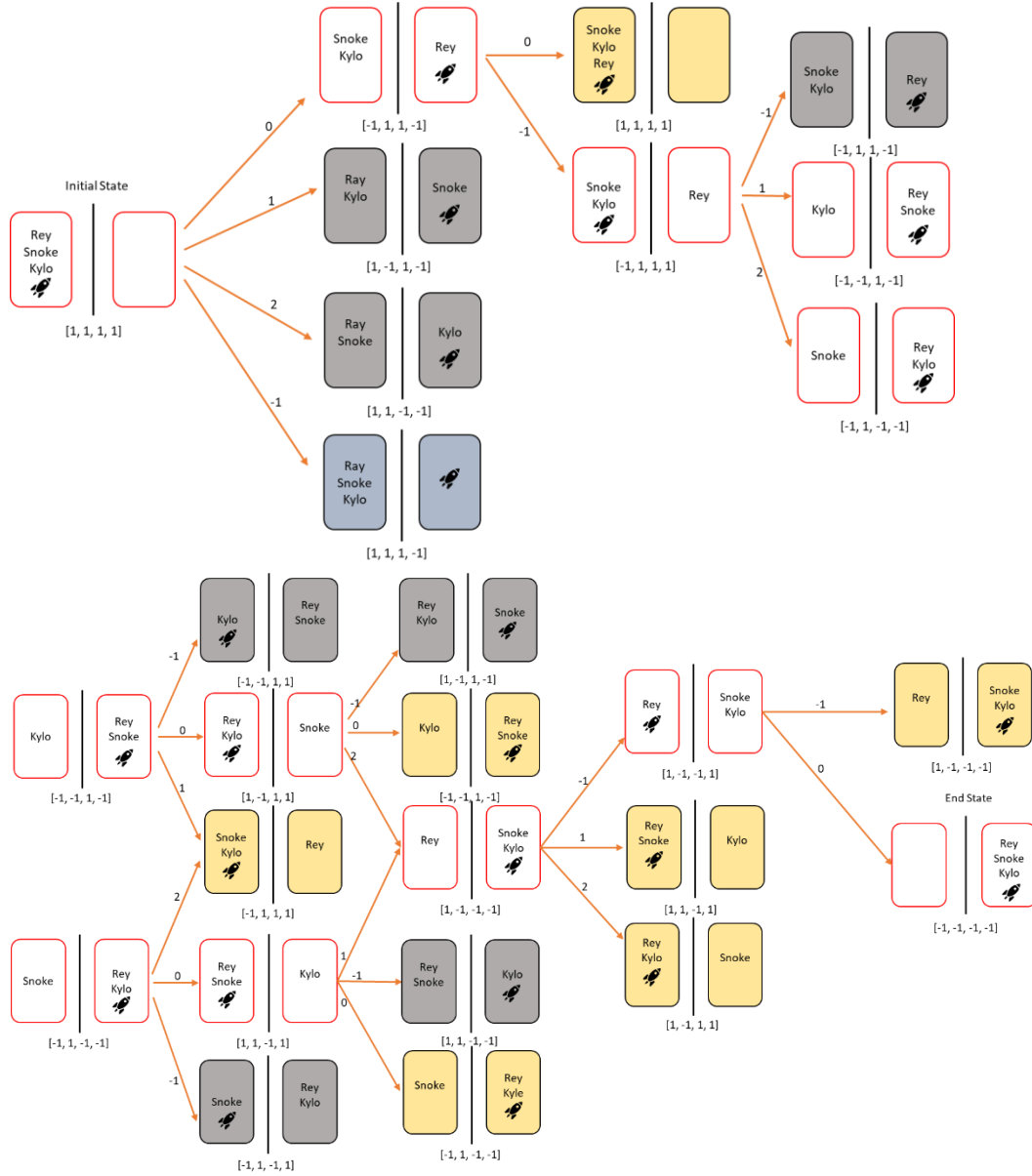
2. The shuttle cannot be left alone on either side. Left alone means no other person is with shuttle. If this is allowed, the only next step is to move the shuttle back the other side. It is waste of time. As to the coding part, it means that
  - state[3] cannot be the opposite sign to all other elements in the state list.

In figure 1, for example, the move -1 is not allowed because of this constraint.

3. The state cannot be same to any of the previous valid states. If this is allowed, the movements are redundant, which reduce the efficiency of our travel plan. As to the coding part, it means that:
  - `current_state_list` cannot be identical to any of the previous valid state lists

Since this problem is relatively simple, all states that do not meet above constraints are kept. No calculation is used to test if a state is closer or further to the end state. The searching only stops when a state equals to the end state.

### 1.3 Entire solution



**Figure 1**—The entire semantic network solution. It follows the same style in Figure 1 above. The rectangle filled with yellow color represents the invalid state due to the 3<sup>rd</sup> constraint in section 1.2

Figure 2 above self explains the whole idea. The solution follows the rectangles with red outlines. All other rectangles are ruled out due to one of the constraints in section 1.2.

## **2 QUESTION 2 – DATA PROTECTION REGULATION**

### **2.1 2016's General Data Protection Regulation (GDPR)**

GDPR first clearly define what the personal data is. It is “any information that relates to an individual who can be directly or indirectly identified”. Data like names and email addresses falls under the definition obviously. Any pseudonymous data that can be used to identify someone falls into this definition too. Based on the definition, this regulation is very strict.

This regulation defines how the personal data should be used from two aspects: the principles that should be obeyed and the circumstances that are allowed to process data. For the first aspect, there are 7 principles, which requires the transparency, fairness and lawfulness, limits the area of data usage, limits the amount of data collected, requests the accuracy of data collected, defines the length of data storage, demands the confidentiality of processing data and asks the responsibility of demonstrating the compliance. In the second aspect, it clearly defines the circumstances that can legally process the person data. In general, the action either need to obtain the permission first or is for public interests or save somebody's life. In other circumstances, don't even collect the data in the beginning.

### **2.2 Apply the GDPR to the use of AI**

GDPR can apply to the use of AI from the data preparation to the data processing. At the data collection stage, the developers either need to get the permission of the user data or use pseudonymous data that cannot identify the person. Before data processing, the AI developers need to clearly define how the data is going to be used. If it is profitable, they need to get permissions as well. In addition, the type of data collected needs to be defined too as it is the developers' responsibility to minimize the data collection. Last but not least, the developers need to make sure the data is up to date, only store for specific purpose and keep the data confidential. During the data processing part, the developers need to keep all the principles on the mind and are responsible for the demonstration of compliance.

### **2.3 An example**

Healthcare industry is a big one that deeply embeds the personalization in its functional purpose. Even for the doctors themselves, they need to analyze previous patient data to make correct diagnosis. They usually get the data from their own experience, through communicating with colleagues and learning based on previous experiments. All above ways include sharing data and facts for individual patient data. As to design AI for diagnosis purpose for example, it needs to access the similar data that the doctor obtains in order to get as much knowledge as the doctors. If there is no data access, there will be no knowledge gain. Therefore, in this industry, the permission of the data transfer from the patient to the doctor and from the doctor to the doctor or from the doctor to a medical company should be very clear. It is not only because the data is essential but also because the data is very private compared to other data like the favorite of a restaurant etc.

### **2.4 the European Economic Area (EEA) and GDPR**

The EEA includes all EU countries and also Iceland, Liechtenstein and Norway. Note that UK is not part of EEA now. There are many GDPR sections related to the example selected in section 2.3. The most important section is “the data subject gave the developers specific, unambiguous consent to process the data” when the data subject fully understands how the data is going to be used. It is usually not simple to explain the usage of patient data as it is complicated than the common sense of most people. Therefore, it is the responsibility of the developers to explain the purpose in details.

To adapt the GDPR restrictions, the developers should be respect to the privacy of personal data from the bottom of the heart. In addition, they need to get familiar with all the regulations and ask permission of data usage in advance. If above actions are too much for the developers, it is suggested to hire attorneys to determine if every step in AI development meets the regulations together.

I personally feel it is possible to allow users in the EEA to use the tools without waiving their GDPR even though the GDPR is probably the toughest regulations regarding the personal data. If the developers always explain the usage of data clearly and ask permission from the users, they should be able to obtain the data they need to and perform the ongoing analysis.

### 3 REFERENCES

1. <https://access.tufts.edu/general-data-protection-regulation-gdpr#:~:text=The%20EEA%20GDPR%20applies%20to,Iceland%2C%20Norway%2C%20and%20Liechtenstein.&text=Switzerland%20has%20also%20adopted%20a%20privacy%20law%20analogous%20to%20the%20GDPR.>
2. [https://www.gov.uk/eu-eea#:~:text=The%20European%20Economic%20Area%20\(%20EEA,part%20of%20the%20single%20market.](https://www.gov.uk/eu-eea#:~:text=The%20European%20Economic%20Area%20(%20EEA,part%20of%20the%20single%20market.)
3. <https://gdpr.eu/what-is-gdpr/>