

# Homework 1: (Spring 2022)

## CS7637

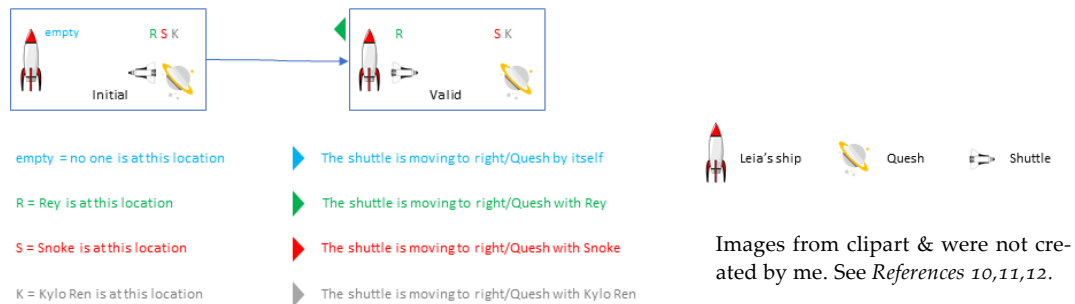
Sascha Calkins  
scalkins7@gatech.edu

### 1 SEMANTIC NETWORK: REY, SNOKE, & KYLO QUESH RETREIVAL

I first defined my semantic network, and then I used generate-and-test to explore the entire problem space, determine valid and invalid states, and find a solution.

#### 1.1 Semantic network set up

Each node in my semantic network is a state. The structural part is the arrow that shows the transformation from one node's state to the next node's state. For each node, I have included triangle labels showing the person who is moved (*i.e.*, **Rey**) and their direction of movement (*i.e.*, left). The triangle labels are the color of the person being moved (*i.e.*, **green**) and point in the direction of movement. The shuttle is marked next to Leia's ship or Quesh depending on its location. The legend in *Figure 1* provides an example of my semantic network & its format.



*Figure 1*—Semantic network set up and legend. Source: [Lesson 03.10. Semantic Networks for Guards & Prisoners.](#)

#### 1.2 Generate & test applied to solve semantic network

For my solution below, my generator will generate 1 of 4 possible moves: move empty shuttle, move Rey, move Snoke, or move Kylo Ren. It is smart enough that it will not try to move Rey from the planet if she is on Leia's ship, but it will try to move everyone who is present as well as send the shuttle empty, except in the case where all people are on the same side as the shuttle and sending an empty shuttle would result in no progress.

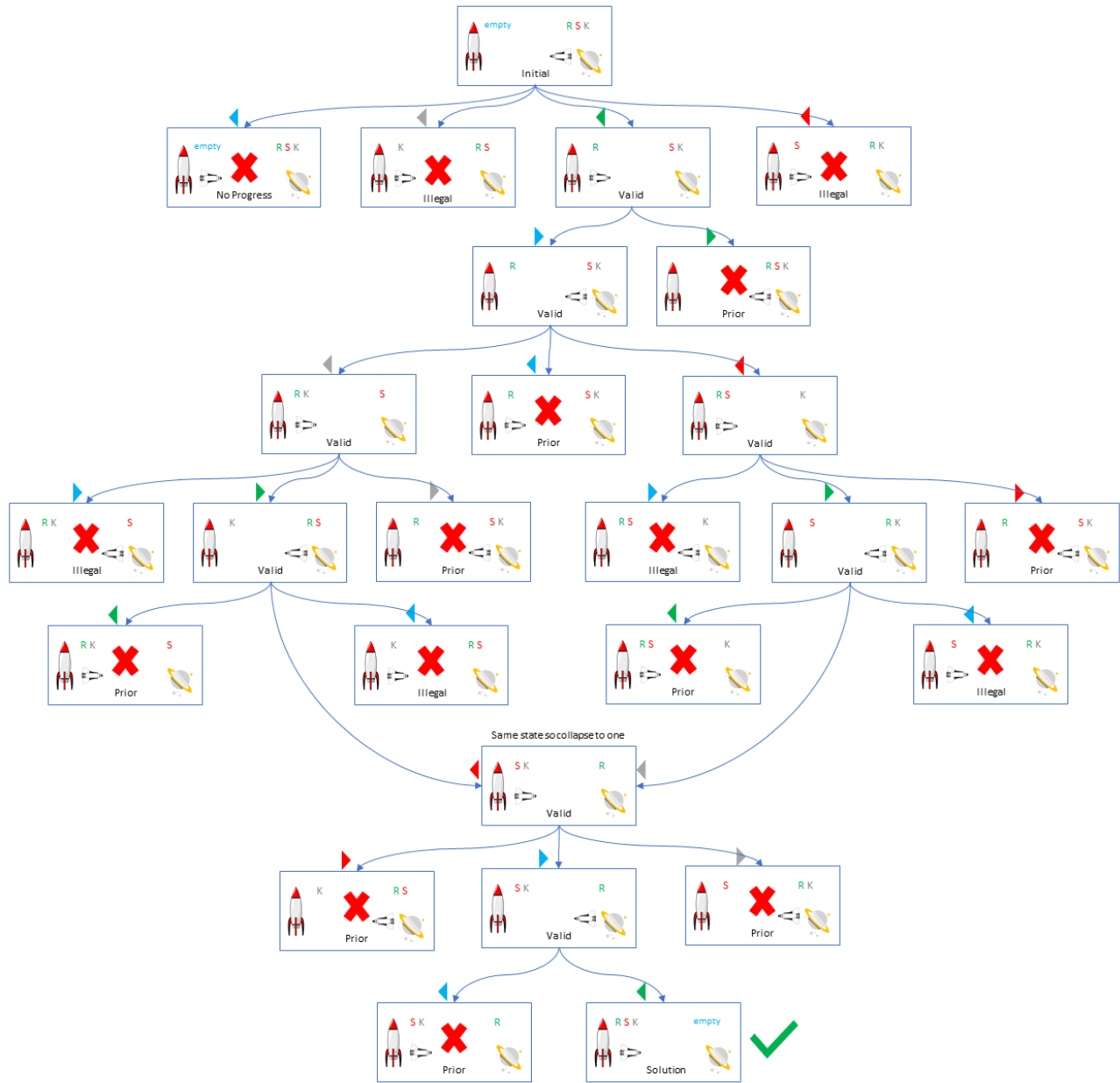


Figure 2—Entire semantic network that solves Quesh problem.

Source: 03.11. Solving the Guards and Prisoners Problem.

My semantic network explores the entire problem space. My tester checks each state the generator creates and either rules it out (illegal, prior, no progress) or marks it valid. My generator then creates all possible moves from each new valid state, ensuring all future moves from the valid states are explored. My tester will remove a state if it is: illegal (*i.e.*, Rey & Kylo Ren or Rey & Snoke, no shuttle), if

it is a prior state (*i.e.*, All people and shuttle are in identical positions as in a past state.), or if no progress is made (*i.e.*, sending empty shuttle from location with all 3 people). Failed states are marked with a red X in *Figure 2*. At the 6<sup>th</sup> level of moves, my generator creates an identical state in both valid solution paths, so these 2 states are collapsed together (*i.e.*, this problem has 2 optimal solutions). My Agent uses a breadth-first search so when a solution is found, it is optimal, and my tester returns it. The solution has a green check by it in *Figure 2*.

## 2 GENERAL DATA PROTECTION REGULATION PASSED BY THE EUROPEAN UNION (EU) IN 2016

The General Data Protection Regulation (GDPR) passed in 2016 and went into effect in May of 2018. To understand the impact of GDPR on usage of personal data to personalize online user experiences, we must understand (1) GDPR definition of personal data and (2) GDPR's restrictions on collecting, storing, and processing personal data.

**Definition:** In Article 4, Personal data is defined as all information that can directly or indirectly identify a person by means of name, ID number, geographical data, online ID, or any personal characteristics: physical, biometric, physiological, genetic, mental, economic, cultural, or social identity.<sup>1</sup> It also includes cookie tracking. Processing personal data encompasses processing performed by humans or automation, including AI.

**Restrictions:** GDPR's Article 5 states that personal data must be: processed in a manner transparent to the person, only collected for initial agreed-upon purpose only stored or further analyzed in a manner consistent with the initial purpose, restricted to the data actually needed for agreed-upon purpose, updated with any misinformation removed in a timely fashion, stored to identify individuals for no longer than necessary to process the data for the agreed upon purpose, and processed in a secure fashion.<sup>1</sup>

### 2.1 How this regulation applies to AI personalizing experiences

These definitions, clarify that any useful data for personalization must be subject to the GDRP and that processing personal data, whether processed by a person or an AI Agent, must comply with the GDRP. Since users and governments are

<sup>1</sup> intersoft consulting. (2018). "[General Data Protection Regulation](#)." In intersoft consulting webpage.

becoming more focused on data privacy, even more stringent privacy regulations are likely in the future. Thus, companies must focus on personal data protection for future products and services, especially those involving AI personalization.

For a company to personalize a product or service, personal data must be collected and stored to provide the best experience for customers and retain them. Many products and services require a great deal of personalization, lending them to AI personalization. However, the GDPR initially appears potentially problematic for this purpose. Although the GDPR is an EU regulation, it applies to companies based outside the EU if they have interactions with or store data from people in the EU or plan to transfer EU data outside the EU (*i.e.*, If an EU person visits your website, you are required to meet the GDPR.). The regulation seems to be more problematic for Big Tech companies (*i.e.*, Google, Facebook, Apple) that cross-feed personal data from individual products and services to the rest of their platform. This is no longer allowed, since personal data may only be collected for the specified applications; companies have been sued for “forced consent” for not using an individualized “opt-in” process or where the consent process required users to waive GDPR protection completely to use the service.

However, GDPR is not necessarily all negative when seeking to use AI to personalize user experiences. GDPR merely forbids collection of personal data in sneaky ways and gives users more control over what data is used by whom. Deloitte’s 2017 study determined 79% of users surveyed were willing to share personal information if viewed as a benefit to their experience with a product or service. Deloitte found 3 factors caused users to feel more comfortable about sharing personal data: (1) the company is transparent about how it will use their data, (2) the company allows users a no-hassle method of opting out of sharing data without hiding these options deep in its settings or reverting privacy settings the next time users log in (*i.e.*, Spotify’s private viewing mode that can’t be set as default), and (3) the company avoids hiding behind legalese in privacy agreements.<sup>2</sup> So, if companies seeking to provide personalized AI experiences follow these guidelines and seek to foster user trust, GDPR could be beneficial since it requires accurate, up-to-date user data, thus allowing for better user personalization. Also, by focusing on building user trust (*i.e.*, focus on explaining

<sup>2</sup> Deloitte Insights. (2017). "[To share or not to share: What consumers really think about sharing their personal information](#)". In Deloitte webpage.

tangible benefits instead of just asking for data to upsell them), companies can build customer loyalty, thus increasing user willingness to provide even more data to further personalize services, creating higher customer switching costs.

## **2.2 Industry where personalization is beneficial but not essential for service**

Personalization is beneficial but not essential in the news apps industry. Many news apps utilize personal data to generate a recommendation engine to serve articles of interest to their users (*i.e.*, offer additional articles on a topics being read or based on prior reading content), to provide local news articles based on user's geographical data, and to aggregate news tailored to an individual's interests from multiple news agencies/sources. Aside from potentially designing an echo chamber of news corresponding to only their views, this service can benefit users by helping them easily find articles in their areas of interest without having to search extensively. However, opting out of personalization would not prevent news apps from working. A user would just have to search for local news and desired topic themselves. In fact, some apps are offering a non-personalized news feeds to try to allow for more well-rounded news (*i.e.*, startup Gawq).

## **2.3 Device that requires personalization for service**

A device requiring personalization for service is a Google Mini with Google Assistant (or any other virtual assistant). The whole purpose of a virtual assistant is to keep track of your schedule (*i.e.*, it needs access to your calendar), control automations in your home and provide security (*i.e.*, requires your address for emergency services and has access to video from security devices). Further, it requires you to set up a Google Home account (*i.e.*, receives data from compatible connected devices), creates lists for you (*i.e.*, knows what tasks you're planning, food you buy), connects media accounts (*i.e.*, knows content you consume), and requires voice authentication (*i.e.*, stores voice biometrics data). However, given the benefits provided, many users are willing to waive privacy to use the device/service. I currently have a Google Mini stalking me from my desk, probably ready to give me all kinds of Google New recommendations about the GDPR.

## **2.4 European Economic Area (EEA) & Relevant sections of GDPR**

The European Economic Area (EEA) consists of all members of the European Union (EU) and the other 3 members of the European Free Trade Association (EFTA). The GDPR covers all members of the EEA.

**Relevant GDPR sections:** Chap 1 contains general provisions and definitions to allow both companies to understand the entire GDPR. Chap 3 outlines the user's rights, which is relevant to both as they need to understand the protections GDPR offers in order to not violate them. Chap 2, in particular, Art 6 (Lawfulness of processing) & Art 7 (Conditions for Consent) is important to both, but particularly Google as it needs the users' consent for its Assistant to work. Chap 8, in particular, Art 83 lays out the punishments for violating the GDPR, which is relevant to both (France leveraged a €50 million fine on Google). Chap 4 specifies controller and processor responsibilities: securing data, reporting breaches, certification requirements. With Art 37 requiring companies to appoint a data protection officer, and Art 27 requiring an EU-based POC to assure adherence. Chap 5 covers transfer of information outside the EU (both my examples are US-based). Chap 6, 7, 10 seem less important, focusing on procures for EU countries to set up their supervisory authorities and cooperate. Chap 9 deals more with official/government documents. Chap 11 deals with superseded past directives.

## **2.5 Can these devices be adapted to GDPR restrictions?**

News apps can be readily adapted to GDPR restrictions. The New York Times has an opt out page for the third parties it shares user data with [www.nytimes.com/privacy/third-party](http://www.nytimes.com/privacy/third-party) and a page clearly describing how it uses personalization: [help.nytimes.com/hc/en-us/articles/360003965994-Personalization](http://help.nytimes.com/hc/en-us/articles/360003965994-Personalization), thus meeting the transparency requirement. The New York Times also willingly has an open dialog about personalization and allows users to provide feedback, All of which seem like good methods to develop user trust. Thus, if the user opts out, apps would be less tailored to user interest but would still be able to provide general news coverage.

However, having Google Assistant meet GDPR restrictions seems unlikely unless a user opts-in or waives GDPR rights. Purchasing a Google Mini and not allowing Google Assistant to collect personal data would render it an expensive paper weight unable to respond to you or provide any service. Minimally, the assistant would need to store voice recognition information, which is protected under GDPR. I think Google could meet restrictions with the caveat that the user is willing to opt in and the agreed upon time period for data storage is while the user uses Google Assistant. However, this borders on "forced consent", which unsurprisingly, Google was sued for within hours of GDPR implementation.

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