Homework 1
Submission Report

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1 INTRODUCTION

This homework assignment will address two fairly independent topics. Firstly, a semantic network will be presented as a form of knowledge representation for a Star Wars-themed problem that is analogous to the Prisoners & Guards and Sheep & Wolves problems that we have seen in previous lectures and assignments. This semantic network will be presented in its entirety and subjected to checks derived from the "Generate & Test" problem-solving methodology. Secondly, an analysis of the 2016 EU General Data Protection Regulation will be presented, focusing specifically on how the takeaways from this regulation could impact the usage of personalization in a few exemplary devices, as well as the usage of artificial intelligence as a whole.

2 SEMANTIC NETWORK REPRESENTATION

Prior to proceeding with the semantic network depiction, it is important to briefly highlight the bounds of the Star Wars problem that is provided for this assignment. Ignoring the Star Wars background of the characters, the problem ultimately involves three individuals, Snoke, Kylo, and Rey, who are currently stuck on the planet Quesh. These three stranded individuals must use a shuttle to make their way back to an orbiting spaceship. An additional character, Leia, awaits their arrival on the spaceship; however, given the bounds of the problem description, I will assume that her presence is purely intended to complete the narrative of these stranded passengers. The shuttle can only carry a single passenger; however, it is also capable of travelling between the stations without a passenger. Based on his apparent role in the Star Wars universe, it must be ensured that Rey is never alone with either Snoke or Kylo when the shuttle is at the opposing station. The problem is solved once all three passengers arrive alive at the orbiting spaceship.

In order to solve this problem a semantic network can be used to illustrate the required states and state transitions, as shown in Figure 1 below.

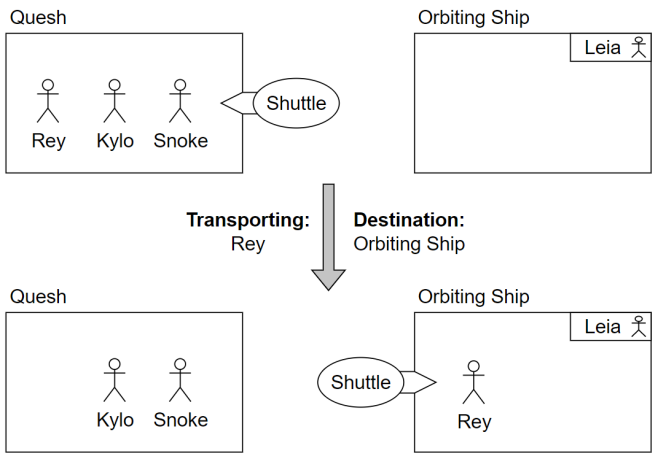

Figure 1—Semantic network with states and state transitions

The semantic network depicts a current state by illustrating the position of the three passengers at the two transit stations, as well as the current location of the shuttle. In order to depict a state transition, a directional arrow, along with text descriptions of the passenger and future shuttle location, are depicted between the individual state diagrams. In the following section a much larger semantic network diagram will be presented to depict the entire solution to this problem.

3 APPLICATION OF GENERATE AND TEST

As detailed in the fourth lecture of this course, the "Generate & Test" problem-solving methodology can be utilized in combination with semantic networks to create and subsequently assess all possible states for this problem. During this lecture, Professors Goel and Joyner highlight the balance that must be found between intelligent generators and testers. In this particular problem, the bounds for the intelligence of these two actors have already been defined.

The generator for this problem should be smart enough to adhere to the two basic rules of the problem statement:

1. Only one passenger can travel in the shuttle.
2. The shuttle can only travel from Quesh to the orbiting ship, or vice-versa.

The generator shouldn't, however, be capable of pre-filtering any of the generated states. If the generated states do not violate the aforementioned rules, then they are valid. The tester is then responsible for the remaining four considerations:

1. Rey should never be alone with Snoke, unless the shuttle is present.
2. Rey should never be alone with Kylo, unless the shuttle is present.
3. Previously seen states should be skipped.
4. Solution – All passengers have arrived on the orbiting ship.

The complete semantic network, as shown in Figure 2 below, considers all possible, valid states that are relevant for the generator. The tester deactivates all paths that are deemed invalid due to a violation of one of the aforementioned rules. In addition to the states and state transitions depicted in Figure 1, the figure below also includes labels for the depth of the analysis, as well as a small legend, to assist the reader in understanding the rule violation that the tester identified.

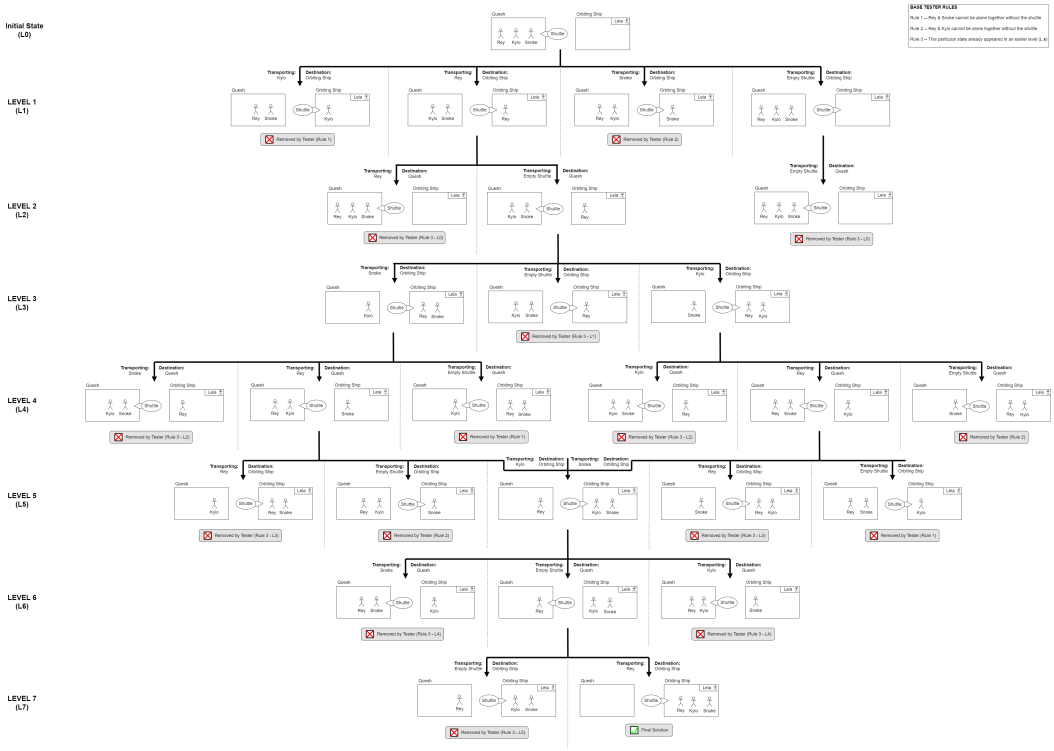

Figure 2—Complete semantic network with generate and test
(Larger, higher-resolution version linked in Appendix)

4 REVIEW OF GENERAL DATA PROTECTION REGULATION

In this section I will briefly describe the scope and intent of the European Union's 2016 General Data Protection Regulation, henceforth GDPR, and the implications that this regulation has for the usage of data personalization. According to the definitions laid out in Article 4, the term "personal data" encompasses essentially

any meaningful data that can be used to directly or indirectly to identify an individual. The regulation empowers an individual to permit, request, understand, and ultimately retract a processing organization's usage of their personal data. As stated in Section 2, Article 13, when personal data is collected from a subject, the processing body must clearly indicate the purposes of the data processing; furthermore, the processing body must also clearly indicate whether the collected information will be utilized for any automated decision-making or profiling mechanisms. The processing body is also required to retrieve additional consent from the user if the scope of the intended data processing expands beyond the originally permitted applications (EU, 2016).

With regards to the usage of artificial intelligence, this regulation presents an interesting issue for any processing organizations. If the processing body intends to use the data from an individual to enable further personalization, they are required to provide meaningful information about the implemented logic and its intended purposes. Meanwhile, as stated in Section 4, Article 21, the user has the right to object at any time to the use of personalization for profiling purposes; therefore, the processing body must design the artificial intelligence to either selectively remove user data from all algorithms and databases or anonymize all incoming data, thereby decoupling it from the regulation (EU, 2016). With any subsequent design iterations, any changes in the artificial intelligence implementation that might modify or enhance the usage of the user data must be subsequently permitted by all affected users.

4.1 Review of products with personalization

To put the aforementioned regulations into perspective, it makes sense to select a few consumer products or organizations with business models that rely heavily on the personalization of user data.

Firstly, I would argue that Pinterest is a company that offers a product with *deeply embedded* personalization. Pinterest is a website that enables its millions of users to create virtual pin boards, where articles and images can be "pinned" by the user. The user finds content for their virtual pin boards by scrolling through an infinite feed of images and articles that have been tailored to fit their interests. When creating a Pinterest account, the user must provide some basic personal information and select a handful of interest categories to populate their feed. The feed can then slowly be further personalized based on additional preference

selections and pinned items. Without this personalization, all users' feeds would be random, untailored content that would likely be less interesting for the target users. Yes, the product would still serve a purpose; however, the selling point of Pinterest would be severely hindered as the likelihood of finding interesting, "pinnable" content would be significantly reduced.

Secondly, I would argue that Stitch Fix is a service that would *cease to exist* without its current degree of personalization. Stitch Fix is an online clothing retailer that requests users to answer a series of questions addressing body size, preferred clothing style, and preferred brand; and, using that information, Stitch Fix will prepare a package of potentially desirable clothing articles and send them directly to the user's home. The user can return all undesirable items, ultimately only paying for the items that they intend to keep, along with a base styling fee. Stitch Fix doesn't actually manufacture any original clothing items, so, if the personalization were to be stripped away from the application, the service would cease to exist. The website would simply contain a repository of clothing items from various brands; however, given there is no added value offered by the website, the service fee would not be justified; and, the company would not be profitable.

4.2 European Economic Area

The European Economic Area, henceforth EEA, is an international agreement, formally established in January 1994, that brings together the 28 EU Member States and three of the EFTA States (Iceland, Liechtenstein, and Norway), creating a homogeneous, continuous economic area. All economic legislation originating from the EU applies to all participating EEA members, thereby ensuring a consistency in economic policy (EFTA, 2013). The GDPR was incorporated into the EEA agreement by the EEA Joint Committee in July 2018 (EFTA, 2018). According to the territorial scope definition in Article 3 of the GDPR, the regulation applies for the processing of data by establishments in the European Union, as well as the processing of data from data subjects who are in the EEA, regardless of the location of the processing establishment (EU, 2016). As a result, all organizations collecting data from users in the EEA must adhere to the GDPR.

4.3 Products in European Economic Area under GDPR

In this section I will briefly highlight articles from the GDPR that would be relevant for the aforementioned products in the EEA. Starting generically, both

Pinterest and Stitch Fix would need to take special precautions to adhere to GDPR Chapter 2, Articles 5-7, which detail the legislation regarding Personal Data Processing, Lawfulness of Processing, and Conditions for Consent respectively. Both companies, regardless of their business models, need to ensure that they receive explicit consent from all users prior to collecting and utilizing any personal information. Furthermore, both companies will also need to consider Chapter 3, Section 2, Article 13, which defines how the processing body should explicitly provide contact information for all data recipients and processors, along with details pertaining to the purposes of the processing and the corresponding legal justifications. Lastly, both companies, regardless of their business models, must adhere to Chapter 3, Section 3, Articles 17 and 20, which define legislation regarding Right to Erasure and Data Portability respectively. The users, after having given explicit consent, must maintain the right to withdraw that consent and have their data erased. Both companies are based outside of the EEA; however, they serve EEA users and must adhere to the GDPR regulations (EU, 2016).

Given its continuously developing model for a user's preferences, Pinterest must adhere to Chapter 3, Section 4, Articles 21, which details a user's right to object to automated individual decision-making practices. With this article, along with the generic elements mentioned above, I believe that Pinterest likely adapts its user agreement to conform with GDPR standards, ensuring transparency in data collection and management. Regular updates in Terms & Conditions with any changes, along with clearly transparent methods for deactivating personalization features, would enable Pinterest to remain functional and GDPR-compliant in the EEA. However, if the user declines all forms of data collection, then they would likely fail to accept the base Terms & Conditions. In this case, Pinterest would likely prohibit the user from creating an account. Stitch Fix must take extra precautions when collecting users weight and height information, as Chapter 2, Article 9 highlights additional measures that must be considered when handling the health, gender, and biometric data of individual users. In order to remain GDPR-compliant, Stitch Fix must ensure that it takes necessary action for the collection, management, and potential deletion of sensitive personal information.

Of course, once they choose to target EEA users, both companies must adhere to the entirety of the GDPR; however, I believe the aforementioned articles are the most relevant for this topic. Assuming these regulations are fulfilled, I see no reason why Pinterest or Stitch Fix could not cater to users within the EEA.

5 REFERENCES

[1] EFTA (2013). "The Basic Features of the EEA Agreement". In: Standing Committee of the EFTA States. URL: https://www.efta.int/sites/default/files/documents/eea/1112099_basic_features_of_the_EEA_Agreement.pdf (visited on 02/04/2022).

[2] EFTA (2018). "General Data Protection Regulation incorporated into the EEA Agreement". In: URL: https://www.efta.int/EEA/news/General-Data-Protection-Regulation-incorporated-EEA-Agreement-509291 (visited on 02/04/2022).

[3] EU (2016). "Regulation (EU) 2016/679 of the European Parliament and of the Council of 27 April 2016". In: Official Journal of the European Union L119. The European Parliament and the Council of the European Union. URL: https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32016R0679 (visited on 02/04/2022).

6 APPENDICES

Additional Google Drive copy of full semantic network
https://drive.google.com/file/d/1Pmn2N06MD_kJRs48SYFNawB0POncus3P/view