National University of Singapore
School of Computing

Semester 2, AY2023-24

CS3263 Foundations of Artificial Intelligence

Issued: 6th Feb. 2025 Due: 21st Feb. 2025@23:59

Assignment 1: More Martian Adventures

Guidelines

Please complete the Assignment in a 2-person TEAM. **ONE person from each team** should submit ALL the answers. Grading will be done team-wise. Please **register your assignment groups** on Canvas **before** submission.

The deadline for the assignment is **21st Feb. 2025, Friday, 23:59 pm**.

On collaboration

You are encouraged to discuss solution ideas. However, each team *must write up the solutions independently*. It is considered plagiarism if the solution write-up is highly similar to other teams' write-ups or other sources.

Assignment Environment Setup

- You can download the programming package from **Canvas**.
- We are using Jupyter Notebook to code and show instructions. You can download and set up the notebook environment here.
- We recommend using Python's package management tool, such as Anaconda, which can be installed as here.

Assignment Solutions Submission

- No late submissions are allowed.
- Complete the codes in `Problem[x]-[YYY].ipynb` and **copy** your solutions to `solution[x].py` script, **indicated by the corresponding coding blocks**. (Detailed instructions are given in the Notebook.)
- Please note that you are not able to run the `solution[x].py` from your end, but don't worry, because they are designed for our evaluation.
- Please write the following on the top of your solution files:
  - *Name* and *matric number* of **all team members** as they appear on Canvas.
  - Collaborators (write **None** if no collaborators)
  - Sources, if any, or if you obtained the solutions through research, e.g., through the web.

- Your solutions should be zipped and strictly named as `netid1-netid2.zip`, where "netid" is the id starting with `e...` **Only submit the zipped file to Canvas**. The folder structure should be strictly formed as follows:

```
netid1-netid2.zip
├── Problem1-FriendlyMartianHero.ipynb
├── Problem2-SafeMissionsOnMars.ipynb
├── solution1.py
└── solution2.py
```

Overall Instructions

You can find the tasks with detailed walk-throughs in the `Problem[x]-[YYY].ipynb` notebooks. You are expected to fill in some code blocks to complete the Martian adventures, which are indicated by:

```
# --- Task 1:  Your codes start here.  ---

# --- Task 1:  Your codes end here.  ---
```

Please **DO NOT** modify or add any codes outside the indicated blocks.

After completing the codes in notebooks, **copy** you codes to the corresponding `solution[x].py` scripts, as indicated by the respective coding blocks.

Problem 1: Friendly Martian Hero

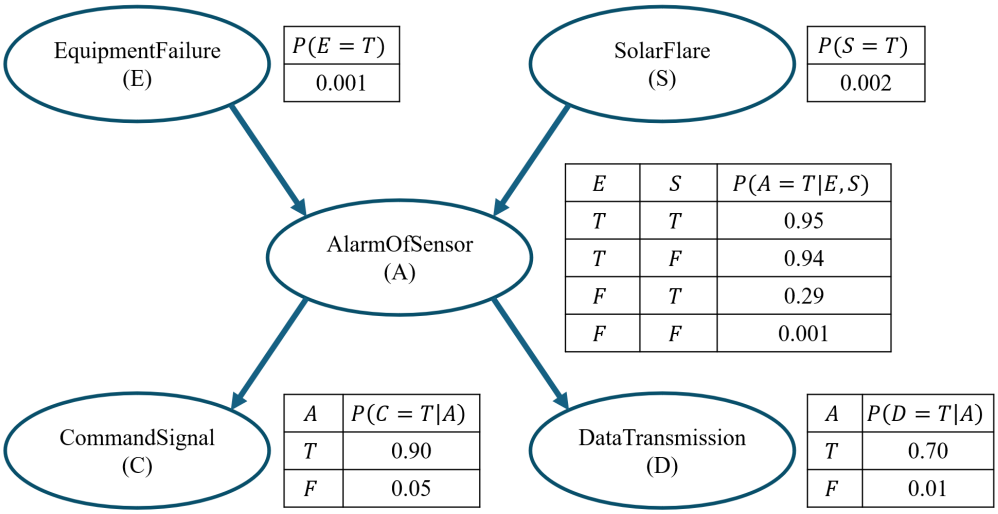
In this problem, we are going to investigate an important AI paradigm - logical representation and inference. We will develop a knowledge base in first-order logic, and draw interesting inferences using Forward Chaining and Backward Chaining algorithms - the foundations of AI rule-based systems that are still very useful in practice.

Refer to the `Problem1-FriendMartianHero.ipynb` for more instructions.

After you complete, remember to **copy your solutions** into the `solution1.py` for our evaluation.

Problem 2: Safe Missions on Mars

In this problem, we will use the Bayesian network in Figure 1 with binary variables to model events in Persy the Mars Rover's adventures. We'll compare two knowledge representation approaches,



$P(E = T)$
0.001

$P(S = T)$
0.002

E	S	$P(A = T \mid E, S)$
T	T	0.95
T	F	0.94
F	T	0.29
F	F	0.001

A	$P(C = T \mid A)$
T	0.90
F	0.05

A	$P(D = T \mid A)$
T	0.70
F	0.01

Figure 1: The Bayesian networks of Percy's Martian adventure.

the *logical representation* and *Bayesian network representation*, in terms of their implementation and learning effectiveness.
Refer to the `Problem1-FriendlyMartianHero.ipynb` for more instructions.

After you complete, remember to **copy your solutions** into the `solution2.py` for our evaluation.