**Al Imam Mohammad Ibn Saud Islamic University**

**College of Computer and Information Sciences**

**Computer Science Department**

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| **CS 340 – Artificial Intelligence**  **Spring 2020 - Semester Project**  **Developing Interactive AI Tutorials**  *Teaching is the best way to learn.* |

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6. **Description**

In this project you will write three interactive AI tutorials (Solving Problems by Searching, Adversarial Search and Constraint Satisfaction). You will write them as Jupyter notebooks which implement and explain some of the essential algorithms you have seen in class.

The Jupyter notebook has to explain the algorithms and related concepts in both Arabic and English, and most importantly it has to explain how to implement the algorithms from scratch.

The notebook should also contain at least one appropriate formulated problem for each notebook, to which the algorithms are applied, and, where applicable, their performance evaluated and compared. These problems should preferably be simplified problems from our background and daily interactions.

You should guide the reader to test and change variables in the problem/algorithm so they can understand the important concepts.

The following table contains the algorithms you need to explain, implement, and show their performance on the formulated problem.

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| **Notebook Title** | **Main Concepts** | **Algorithms** |
| Solving Problems by Searching | * Problem formulation   + Initial state   + Actions   + Transition model   + State space   + Goal test * Informed search   + Heuristic functions   + A\* * Local search   + Complete vs incremental problem configurations.   + Simulated annealing | * A\* * Simulated Annealing |
| Adversarial Search | * Game formulation   + Evaluation function   + Alpha-beta algorithm | * Alpha-Beta |
| Constraint Satisfaction | * Constrain Satisfaction Problems * Inference techniques * Heuristics for CSPs | * Forward Checking |

A suggested notebook layout is as follows:

* Introduction
  + Explains the objectives and main concepts.
* An example problem
  + Explains the problem and its formulation.
* The algorithms, for each algorithm
  + Explanation
  + Implementation
  + Applying the algorithm on the problem
  + Testing the algorithm on several samples and reporting the results
* References and resources

To help the reader visualize the algorithm the notebook should also contain figures, and preferably useful animations.

**It is very important to correctly cite any resource you use, failure to do so is considered plagiarism. Refer to section 3. Grading.**

Examples of existing notebooks that you may use as guidance, however using the existing search code is not accepted.

1. <https://github.com/norvig/pytudes#pytudes-index-of-jupyter-ipython-notebooks>
2. <https://github.com/Calysto/aima3/blob/master/notebooks/search.ipynb>
3. **Deliverables**
4. The three notebooks and any related files like figures, animations, data files... all submitted in a zipped folder.
5. An oral demonstration.
6. **Grading**

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| **Component** | **Marks** | **Notes** |
| Explanation of concepts | 5 | Correct and clear explanation of concepts using figures. |
| Problem formulation | 3 | Appropriate examples, and correct formulation and implementation. |
| Algorithm Implementation | 10 | Correct execution, enable reader to adjust variables. |
| Testing | Testing the algorithm on several samples and reporting the results in a table format. |
| Demonstration | 2 | Communication, and team work skills will be assessed. |
| Understanding of the code | 100% | The total grade will be affected by this percentage. Each student will be assessed individually. |
| Total | 20 |  |

There are up to 3 bonus marks for outstanding projects.

**Any suspicion of cheating and plagiarism will be dealt will seriously and raised to the department which will result in failing the course. Also make sure there is no plagiarism especially in the theoretical background, you need to write the theoretical background in your own words in both Arabic and English.**

1. **Deadline**

The deadline is on Tuesday **29/Rajab/1441 - 24/March/2020.**

1. **Supplements**
2. How to install Anaconda, it includes Python, several IDEs and python packages.

<https://docs.anaconda.com/anaconda/install/>

1. The basic topics in python that you might need in the project depending on your implementation are dealing with:
   1. Lists.
   2. Numpy arrays.
   3. Reading text files.
   4. Defining functions.
   5. Defining classes.
2. Jupyter notebook documentation (contains examples):  
   <https://jupyter-notebook.readthedocs.io/en/stable/>
3. Introduction to Jupyter notebook:   
   <https://realpython.com/jupyter-notebook-introduction/>