Assignment 3

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COMP 456 – Artificial Intelligence

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# Question 1

# The 3 main components of production systems are:

1. **The set of production rules**. These are often simply called productions. A production is a condition–action pair and defines a single chunk of problem-solving knowledge. The condition part of the rule is a pattern that determines when that rule may be applied to a problem instance. The action part defines the associated problem-solving step(s).
2. **Working memory** contains a description of the current state of the world in a reasoning process. This description is a pattern that is matched against the condition part of a production to select appropriate problem-solving actions. When the condition element of a rule is matched by the contents of working memory, the action(s) associated with that condition may then be performed. The actions of production rules are specifically designed to alter the contents of working memory.
3. **The recognize–act cycle**. The control structure for a production system is simple: working memory is initialized with the beginning problem description. The current state of the problem-solving is maintained as a set of patterns in working memory. These patterns are matched against the conditions of the production rules; this produces a subset of the production rules, called the conflict set, whose conditions match the patterns in working memory. The productions in the conflict set are said to be enabled. One of the productions in the conflict set is then selected (conflict resolution) and the production is fired. To fire a rule, its action is performed, changing the contents of working memory. After the selected production is fired, the control cycle repeats with the modified working memory. The process terminates when the contents of working memory do not match any rule’s conditions.

# Question 2

**Data-driven** search begins with a problem description (such as a set of logical axioms, symptoms of an illness, or a body of data that needs interpretation) and infers new knowledge from the data. This is done by applying rules of inference, legal moves in a game, or other state-generating operations to the current description of the world and adding the results to that problem description. This process continues until a goal state is reached.

**Goal-driven** search begins with a goal and works backward to the facts of the problem to satisfy that goal. To implement this in a production system, the goal is placed in working memory and matched against the ACTIONs of the production rules. These ACTIONs are matched (by unification, for example) just as the CONDITIONs of the productions were matched in the data-driven reasoning. All production rules whose conclusions (ACTIONs) match the goal form the conflict set.

# Question 3

The blackboard architecture is a model of control that has been applied to these and other problems requiring the coordination of multiple processes or knowledge sources. A blackboard is a central global data base for the communication of independent asynchronous knowledge sources focusing on related aspects of a particular problem.

# Question 4

Written in **A3Q4**.pl

This program try to solve the farmer problem using:

1. **Breadth-first search**, implemented by using the queue ADT  
   usage: **test\_bf.,** should runs the program using breath-first search  
   custom values test: **go\_bf**(state(F, W, G, C), state(F, W, G, C)).
2. **Depth-first search**, implemented by using the stack ADT  
   usage: **test\_df.**, should runs the program using depth-first search  
   custom values test: **go\_df**(state(F, W, G, C), state(F, W, G, C)).