CMPS 161 – (Programming?) Assignment #1
The Wandering Robot

All too often we get caught up in the details of programming, without first appreciating the simple idea of breaking a problem down into steps, which is the essence of programming. So here is a programming assignment without any of the details --

- No computer languages
- No variables
- No computer jargon
- No computer!

You will be working in groups. We will choose a playing surface on campus. Each group will attempt to "program a robot" to find its way from a start point on the playing surface to an end point on the playing surface, while avoid obstacles which may be in the way. The number or arrangement of obstacles will not be known ahead of time. Nor will the boundaries of the playing surface.

The "robot" will be your instructor -- so you cannot expect it to interpret vague instructions to your advantage. Be as specific as possible, so as to leave no room for interpretation.

The "program" will be a list of rules. Each rule consists of two parts:

1. An IF part containing any question about the situation which can be answered with a yes or no, including questions about the start point, the finish point, obstacles, the boundary, or past actions.
2. A THEN part which contains one or more of the following actions:
   - \text{STEP}
   - \text{TURN LEFT} <\text{any integer number}> \text{ DEGREES}
   - \text{TURN RIGHT} <\text{any integer number}> \text{ DEGREES}

The only way to repeat an action is to set it up so that it will be done on the next trip through the rule set. As soon as a rule "fires" (i.e. answers "YES" to the question and executes its THEN part), the robot will go back to the top of the rule list and start over. Those of you who have done some programming before will be tempted to add GOTO's, REPEAT's, WHILE's, and the like, or to use variables. \textbf{DO NOT DO THIS!} You must limit yourself to the primitives supplied (an important part of using any programming language). \textbf{Use only rules as described above.}

Examples:

\begin{itemize}
  \item \text{Good} => IF there is an obstacle in front of the robot and within one step
  \hspace{1cm} THEN TURN LEFT 90 DEGREES AND STEP
  Why? The question is fine, but SIDEWAYS is not a valid action.
  \item \text{Bad} => IF there is an obstacle in front of the robot and within one step
  \hspace{1cm} THEN STEP SIDEWAYS
  \item \text{Good} => IF you could take one step without running into an obstacle or
  \hspace{1cm} leaving the playing field
  \hspace{1cm} THEN STEP
  \item \text{Bad} => IF there is nothing in front of you
  \hspace{1cm} THEN REPEAT
  \hspace{1cm} \hspace{1cm} STEP
  \hspace{1cm} UNTIL there is something in front of you
  Why? The question is too vague, and the commands use a lot of "programmer-speak" which is not in the allowed actions.
  \item \text{Good} => IF you just turned right and you could take one step without
  \hspace{1cm} running into an obstacle or leaving the playing field
  \hspace{1cm} THEN STEP
  \item \text{Bad} => Walk from the start point to the finish point, avoiding all obstacles.
  Why? Not only does this statement not conform to the IF-THEN rule format required, but it asks the robot to do illegal actions.
\end{itemize}

The robot must consider each rule in the rule set from the top down to the bottom. When the robot reaches a rule whose IF part can be answered with yes, he or she must do its THEN part, and start over at the top of the list again. If the robot goes all the way through the list without answering yes, or reaches the finish point, it must stop. The robot will also automatically stop upon touching any obstacle or upon attempting to leave the playing field. The team whose rule set results in the shortest total robot path from start to finish will win the competition.