Homework SET #1

Homework 1: Problems 2.1-2.6 at the end of Chapter 2 in the Nilsson textbook
Due Tuesday September 1, 2015, Lecture 4, in class

2.1 Write the following Boolean function in DNF:

\[ f = (x_1 + x_2)(x_3 + x_4) \]

2.2 Show that

\[ x_1x_2x_3 + \overline{x}_1x_2x_3 = x_2x_3 \]

2.3 Indicate which of the following Boolean functions of three input variables can be realized by a single threshold element with weighted connections to the inputs. You do not need to calculate the weight and threshold values:

1. \( x_1 \)
2. \( x_1x_2x_3 \)
3. \( x_1 + x_2 + x_3 \)
4. \( (x_1x_2x_3) + (\overline{x}_1\overline{x}_2\overline{x}_3) \)
5. 1

2.4 Prove that there are exactly \( 3^n \) monomials of \( n \) dimensions and \( 3^n \) clauses of \( n \) dimensions. {This is simple! Note that the values are \{T,F, and none or HiZ\}, the system is ternary and not binary.}

2.5 Refer to the definitions of the features, \( x_1, x_2, x_3, x_4 \) on page 24 and to the rules for action on page 25. Show that the assumption that there are no “tight spaces” in the two-dimensional grid world implies that no two of the action rules can be satisfied simultaneously.

2.6 Design (by hand) a neural network that accepts as inputs the sensory signals \( s_1, s_2, \ldots, s_8 \) and produces as outputs the conditions needed by a network of TISA units to implement the action rules on page 25 for the wall-following robot. {This is simple! See the TSA figures in the book (e.g., Figure 2.6) and change as appropriate to match your answer.}

CLASS 2 OUTLINE

An example of a Classical AI Problem
N-Queens Problem
An Example of a Modern Machine Intelligence Problem
Q-Learning: Learning to Push a Box
Stimulus-Response (SR) Agents