Some Logic Problems

Here are some logic design problems for you to think about. Have fun!

Problem 1

You are asked to design the logic to control a solar heating system. The solar heating system consists of a collector, a rock energy storage bin, a heated space, an auxiliary heater, and various fans and valves that control the flow of heated air. Temperature sensors are connected at various points within the system. There is one sensor that measures how hot the collector is, one that measures how hot the rock bin is, and one that measures the temperature of the heated space. Assume that you have the following signals available: (these are the **inputs** to your system)

> A signal B that is "1" when the rock bin is warmer than the heated space.
> A signal C that is "1" when the collector is warmer than the rock bin.
> A signal H that is "1" when the sensor in the room says that the room needs to be
> heated because it is too cold.
> A signal S that is "1" when the collector is warmer than the heated space.

You need to provide signals to accomplish the following: (these are the **outputs** from your system)

1. Turn on a fan, F1, when the collector heat is to be transferred to the rock bin.
2. Turn on a fan, F2, when the rock bin heat is to be transferred to the heated space.
3. Turn on a fan, F3, when the collector heat is to be transferred to the heated room.
4. Turn on the auxiliary heater, A, when necessary.

Begin by constructing the truth table for the design. This is a real–world problem, so don't be surprised if you have to make some engineering decisions during the design process. Justify the decisions you make in the design.

Problem 2

The Nellbuck Corp. has four boilers, A,B,C, and D. Boiler A can supply 50% of the steam to run process P, boiler B can supply 40%, boiler C can supply 40%, and boiler D can supply 50%. Devise a truth table that shows when there is enough steam to run the process. Assume A is "1" when boiler A is ready, etc. Write out a simplified Boolean function using Karnaugh maps.