CMPSC 312 **Name:** _____

Computer Organization and Architecture
Fall 2018
Due Date: October 25th, 2018 (4:35 p.m.)

Instructions: Please create the truth tables, Boolean expressions/Kmaps (used to simplify the circuit), and combinational circuit (designed using ***Logisim***) to solve the following problem. Submit electronic (Canvas Dropbox) and printed copies of your circuit AND neat handwritten documents containing all of your truth tables and Boolean expressions/Kmaps to me by the deadline. Please note that printouts are required if you want your submission to be considered for a grade.

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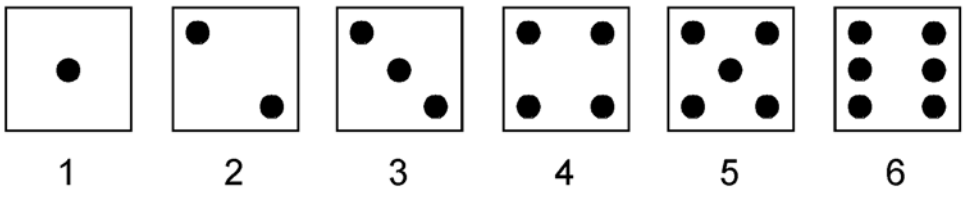
1. Your task is to create a combinational circuit to solve the problem described in the following scenario.

   The Pennsylvania Gaming Control Board is responsible for making sure that all state regulated games of chance are conducted with the utmost honesty. At this time, the Board is in the process of contracting out the construction of an all-electronic craps game. Craps is a casino game played using two cubical dice. Each face of a die is marked with spots (pips) numbered one through six. For our purpose, we don't really care how the game is played, only how the device will work. The game device will consist of two identical modules. Each module will consist of a random number generator submodule and a display submodule.

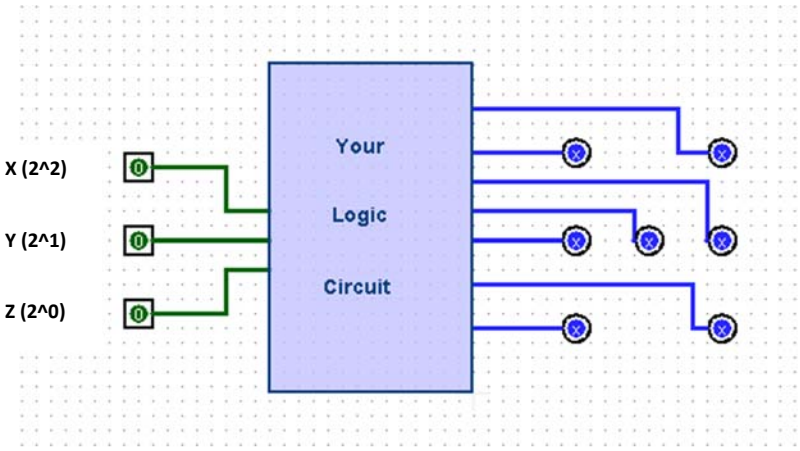
   Because the electronic craps game must produce dice rolls that are scrupulously random, the random number generator is being developed by a top secret military contractor for the considerable sum of $2 million. This cost has nearly depleted the budget for the game device, so the Board has come to Penn State Harrisburg to find some inexpensive student labor for the design of the display submodule.

   The Board has specified that there are three inputs to the display submodule, each of which represents a power of 2 output from the random number generator circuit. Thus, if the random number generator produces a 5, the "1" line and the "4" line will be activated. Accordingly, the electronic display will illuminate 5 of the pips on the face of the display. Although the die can show only numbers 1 through 6, it is possible for all three outputs to be simultaneously activated, producing the output 7. It is also possible for none of the outputs to be activated, producing the output 0. When either of these events occurs, none of the pips should illuminate. The pip patterns are shown below along with their inputs.



Note: 0, 7 illumunate no pips

   Your completed project should be functionally equivalent to the ***Logisim*** screenshot shown at the top of the next page.



Important Notes:

- I recommend constructing your circuit in ***Logisim*** incrementally from the truth tables (i.e., similarly to how you *should* construct a computer program). Try to minimize your circuit to the extent possible.
- You may work on this assignment with one of your classmates. If you decide to do so, please submit one electronic copy and one paper copy containing both of your names.
- Clearly label the inputs to your circuit as shown in the circuit above. Labeling the functionality of the gates is helpful but not required.
- You must document ALL sources (Web, in particular) used to complete this assignment. (Note: I strongly recommend reviewing the Academic Integrity Policy on the CMPSC 312 syllabus.)
