CS 151
Quiz 4

Name : __________________________
      (Last Name)       (First Name)

Student ID : ___________________

Signature : ___________________

Instructions:

1. Please verify that your paper contains 8 pages including this cover.
2. Write down your Student-Id on the top of each page of this quiz.
3. This exam is closed book. No notes or other materials are permitted.
4. Total credits of this quiz are 50 points.
5. To receive credit you must show your work clearly.
6. No re-grades will be entertained if you use a pencil.
7. Calculators are NOT allowed.
Q1: [Function Minimization] [15 points]

Minimize the following function:

\[ F(a, b, c, d) = a'bc'd + ab'cd' \]

Assume that \( a \) and \( b \) can never both be 1 at the same time and that \( c \) and \( d \) can never both be 1 at the same time (these represent don't cares).

The K Map table is shown below.

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A: \( bd \)
B: \( ac \)

\[ F(a, b, c, d) = ac + bd \]
Q2 [Memory Design] [10 points]

Design a 1024x8 bit RAM using 512x4-bit RAM modules shown below.

512x4-bit RAM Module
Q3 [RTL Design] [25 points]

We want to create RTL design of a machine that calculates the number of times a value $b$ is found within an array $A$ (stored in a 256x8 register file) consisting of 256 8-bit values.

The design of the register file is shown as follows:
a). Create a high level state diagram of the machine (15 points)

State diagrams that use fewer states than this one are also possible.
b) Create the datapath of the machine. (10 points)