CIVL 3137
Homework 6

1. (45 pts) Design a non-air-entrained concrete mix that will have a slump of 3-4" and a design strength (f'_c) of 4300 psi using the **absolute volume method**. Assume the following aggregate properties:

Natural Sand	Gravel w/ some crushed particles
Fineness modulus = 2.90	NMAS = ¾"
Absorption = 1.25%	Absorption = 0.95%
Bulk relative density = 2.55	Bulk relative density = 2.66
Dry-rodded unit weight = 106 lb/ft³	Dry-rodded unit weight = 99 lb/ft³

    Don't forget to adjust the water content for the shape of the coarse aggregate. Also, make sure you add enough extra water to your mix design the make the aggregate SSD (but you don't know the moisture content of the aggregate yet, so ignore the last two parts of Step 10). Do all calculations based on a cubic yard of concrete.

2. (5 pts) Calculate the volume (in ft³) of the cement paste (cement + water + air) for the mix you designed in Problem 1. Do NOT include the water added to make the aggregate SSD; that water is not part of the cement paste, it's part of the aggregate.

3. (15 pts) If the coarse aggregate in Problem 1 had a 1½" NMAS instead of a ¾" NMAS, what would be the volume of the cement paste (cement + water + air)? How much more or less is this volume as a percentage of the volume in Problem 1? Note that you don't need to determine the amount of gravel and sand in the mix; just the amounts of cement, water, and air (Steps 3-7).

4. (10 pts) Redesign the mix in Problem 1 using the **estimated weight method**. Don't bother to repeat Steps 1-8 (they won't change); just redo Steps 9 and 10.

5. (10 pts) if the moisture content of the sand stockpile is 4.5% and the moisture content of the gravel stockpile is 1.3%, how much cement, water, and moist aggregate will be needed to make a 1-yd³ batch of the concrete in Problem 1.

6. (15 pts) If the coarse aggregate in Problem 1 was crushed stone (i.e., angular aggregate) instead of gravel with some crushed particles (i.e., mostly rounded aggregate), what would be the volume of the cement paste (cement + water + air)? How much more or less is this volume as a percentage of the volume in Problem 1? Note that you don't need to determine the amount of gravel and sand in the mix; just the amounts of cement, water, and air (Steps 3-7).