Due 06/03, Friday, 17:00
To be dropped into the homework box inside the laboratory.

CE 363-364 Homework-1

State all assumptions clearly. For all questions, you may take ρ_w=1 g/cc, g=10 m/s^2.

1) A shelby tube sampler is cut such that the volume of the soil in the cut piece is determined to be 860 cm^3. The mass of the soil was 1500 grams. After drying, its mass was found as 1200 grams. Specific gravity of solid particles is measured to be 2.65.
   a) Draw the phase diagram with volumes and masses (or weights) of each phase
   b) Calculate water content, bulk density, void ratio, degree of saturation, porosity
   c) What would be the total unit weight and water content if the soil were fully saturated at the same void ratio in its natural state?

2) In a Proctor compaction test, the maximum dry density that corresponds to the optimum water content is found as 1.7 g/cc. Specific gravity of solids is 2.65, maximum void ratio is 0.86, and minimum void ratio is 0.52. A 1.5m (height) x 20m x 20m embankment of this soil is compacted to "98% of Proctor maximum dry density".
   a) Calculate the relative density of the embankment.
   b) Earthworks are priced by volume of soil moved. If hauling soil costs 15 lira/m^3, calculate the maximum possible cost of hauling the soil necessary for this embankment. (*Hint: maximum possible cost would correspond to the maximum possible volume of loose soil to be hauled. This loose soil will be compacted into the embankment at the specified density*)

3) The results of particle size analysis and, where appropriate, Atterberg limit tests on samples of four soils are given in the table below.

Particle size (mm)	Percentage smaller (%)			
	Soil A	Soil B	Soil C	Soil D
19	100	-	-	-
4.75	93	100	-	-
2	70	97	-	-
0.65	31	89	100	-
0.212	14	66	96	100
0.074	3	38	72	98
0.020	-	21	47	89
0.006	-	12	24	70
0.002	-	5	14	59
Liquid limit (%)	-	Non-plastic	27	75
Plastic limit (%)	-		19	38

   a) Plot the grain size distribution curve of each soil (use Excel or graphing softwares)
   b) Determine the percentages of gravel, sand and the fines in samples A and B.
   c) Determine D_{10}, D_{30}, D_{60}, C_U and C_Z of soils A and B, and comment on their gradation.
   d) Classify each soil according to Unified Soil Classification System, write both 2-letter abbreviated form and the open form.
   e) For soil D, if the natural water content is 55%, what is the consistency in its natural state. Determine also the plasticity index and liquidity index of soil D.