1) (5 points) A coarse aggregate sample is used to determine bulk and apparent specific gravity. The following quantities are determined:

- ♦ Oven dry wt. of aggregate = 816.0g.
- ♦ Weight of sample in SSD condition = 829.5g.
- ♦ Weight of submerged container plus water plus aggregate = 778.4g.
- ♦ Weight of submerged container plus water = 248.7g.

Find the bulk and apparent specific gravities. Always report specific gravities to third decimal place.

Solution:

Given A=816.0g, B=829.5g, C=778.4-248.7=529.7g

According to the equation given in class,

$$G_{sb}=\frac{A}{B-C}=\frac{816}{829.5-529.7}=2.722 \quad (2)$$

$$G_{sa}=\frac{A}{A-C}=\frac{816}{816-529.7}=2.850 \quad (3)$$

2) (5 points) Suppose two different samples of aggregate are used to conduct absorption and specific gravity tests. Modify the equations in the text to obtain absorption, bulk, and apparent specific gravity, given the following:

- Sample #1:
  - ♦ Oven dry wt. of aggregate = 960.3g.
  - ♦ SSD wt. Of aggregate = 980.3g.
- Sample #2:
  - ♦ Weight of container with sample, submerged in water = 760.2g.
  - ♦ Weight of empty container, submerged in water = 68.5g.
  - ♦ Oven dry wt. of aggregate = 1070.5g.

Solution:

Given:

A_1=960.3g, D_1=983.0g, A_2=1070.5g, B_2=68.5g, C_2=760.2g

According the equation given in class,

$$ABSP(\%)=\frac{D_1-A_1}{A_1}\times 100=\frac{980.3-960.3}{960.3}\times 100=2.083 \quad (1)$$

$$D_2=A_2\times\left(1+\frac{ABSP}{100}\right)=1070.5\times\left(1+\frac{2.083}{100}\right)=1092.795 \quad (1)$$

$$G_{sa}=\frac{A_2}{B_2+A_2-C_2}=\frac{1070.5}{68.5+1070.5-760.2}=2.826 \quad (1)$$

$$G_{sb}=\frac{A_2}{B_2+D_2-C_2}=\frac{1070.5}{68.5+1092.795-760.2}=2.669 \quad (2)$$

3) (5 points) Suppose that you run a fine aggregate angularity test and obtain the following results:

Volume of container = 100 cm^3

Weights of sample for twelve trials (g) = 154.2, 152.9, 152.9, 154.1, 153.8, 153.8, 154.9, 152.4, 154.5, 154.3, 152.2, 152.0

G_{sb} of aggregate = 2.595

Will this aggregate pass Superpave specifications for a road with $12*10^6$ design EASLs, if it is to be used as the top lift of a surface course? (Superpave requires the uncompacted voids should not exceed 45% if used as a surface course)

Solution:

Given: V=100cm^3, the average weight of twelve trials W_{avg}= 153.5g, G_{sb}=2.595

Therefore,

The uncompacted voids

$$= \frac{V - W/Gsb}{V} \times 100\%$$

$$= \frac{100 - 153.5/2.595}{100} \quad (3)$$

$$= 0.408 = 40.8\% < 45\%$$

According to the Superpave specifications, for a road with $12*10^6$ Design ESALs, if it is to be used as the top lift of a surface course, the uncompacted voids should not exceed 45. Therefore, this aggregate will pass the Superpave specifications. (2)

4) (5 points) Draw the maximum density line and gradation line for the following gradation according to the Superpave method. Indicate corresponding sieve sizes at x-axis.

Sieve (mm)	12.5	9.5	4.75	2.36	1.18	0.6	0.3	0.15	0.075	<0.075
Mass retained in each sieve (g.)	0	66	177	204	159.3	85.4	78	125.7	61	17.6

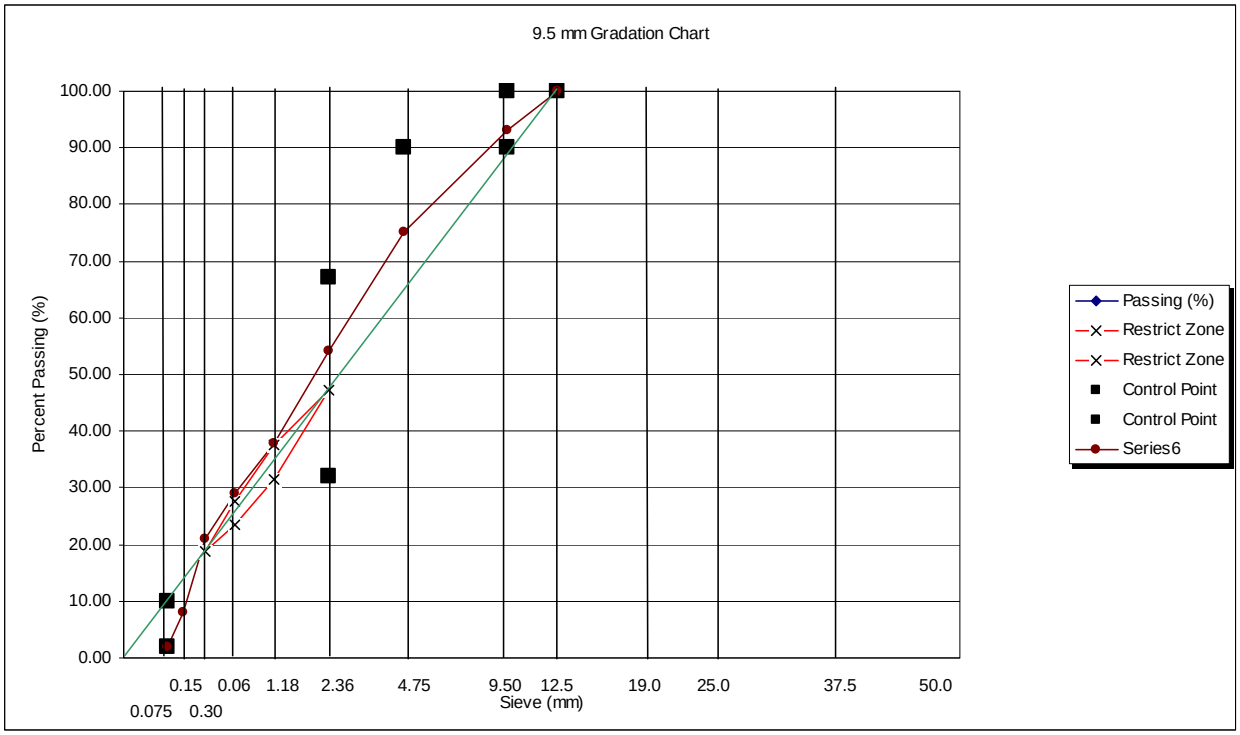
Solution:

According to the calculation in the table, nominal maximum size is 9.5mm, and maximum sieve size is 12.5mm.

sieve	Mass retained	Cumulative		
(mm)	(g.)	Mass Retained	% retained	% Passing
12.5	0	0	0	100
9.5	66	66	6.78	93.22
4.75	177	243	24.95	75.05
2.36	204	447	45.89	54.11
1.18	159.3	606.3	62.25	37.75

0.6	85.4	691.7	71.02	28.98
0.3	78	769.7	79.02	20.98
0.15	125.7	895.4	91.93	8.07
0.075	61	956.4	98.19	1.81
<0.075	17.6	974	100	0

(1)



(2)

sieve	% Passing	SA Factor	Surface Area
(mm)	(%)		ft^2
12.5	100	2	2
9.5	93.22	0	0
4.75	75.05	2	1.501
2.36	54.11	4	2.1644
1.18	37.75	8	3.02
0.6	28.98	14	4.0572
0.3	20.98	30	6.294
0.15	8.07	60	4.842
0.075	1.81	160	2.896
<0.075	0	0	0
		Σ	26.77

(2)