Sand analysis exercise

Two 0.15kg samples of sands from different locations are passed through sieves of decreasing size until all the material is retained. The contents of each sieve is then weighed and the results are given in the two tables.

Sand A

Sieve size (mm)	Weight retained (kg)
4	4.32 x 10-3
2	3.174 x 10-2
1	6.384 x 10-2
0.5	2.562 x 10-2
0.25	1.53 x 10-2
0.125	7.23 x 10-3
0.0625	1.95 x 10 -3

Sand B

Sieve size (mm)	Weight retained (kg)
4	0
2	0
1	0
0.5	3.45 x 10-3
0.25	4.812 x 10 -2
0.125	9.291 x 10-2
0.0625	5.52 x 10-3

For each sample plot a frequency graph with size frequency against grain size. Plot this data as a bar chart.

Calculate the mean grain size for each sample.

What can you say about how well sorted the samples are?

Does each sample have a normal distribution or is it skewed and if so which way?

One sample was collected from a beach and the other from a river. Is there any evidence that tells you which is which?

Sand analysis exercise - solution

From the two tables, first find the percentage by weight in each sieve.

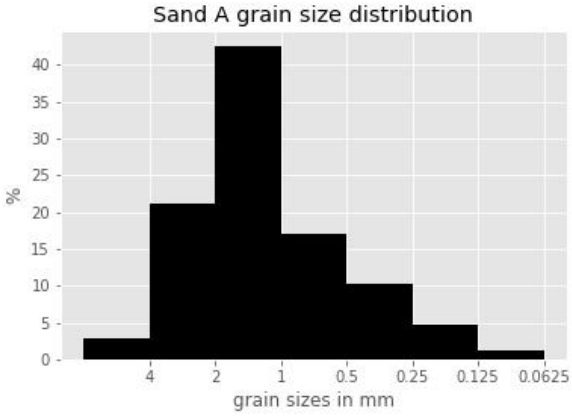
Sand A

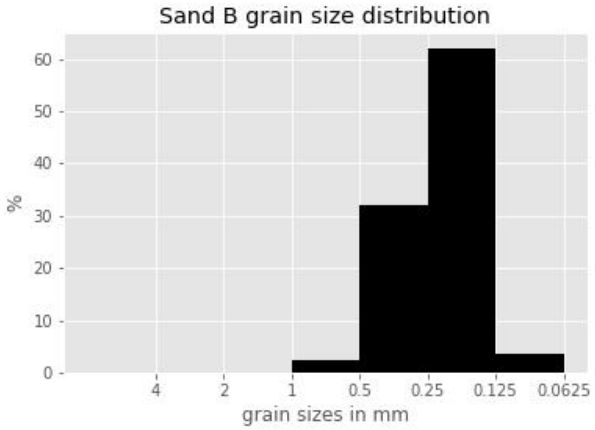
Sieve size (mm)	Weight retained (kg)	percentage by weight %
4	4.32 x 10-3	2.88
2	3.174 x 10-2	21.16
1	6.384 x 10-2	42.57
0.5	2.562 x 10-2	17.09
0.25	1.53 x 10-2	10.20
0.125	7.23 x 10-3	4.83
0.0625	1.95 x 10 -3	1.27

Sand B

Sieve size (mm)	Weight retained (kg)	Percentage by weight %
4	0	0
2	0	0
1	0	0
0.5	3.45 x 10-3	2.3
0.25	4.812 x 10 -2	32.0
0.125	9.291 x 10-2	62.0
0.0625	5.52 x 10-3	3.7

Plot sieve size as ordinate (x value) and percentage as abscissa (y value) the 2 plots are as given here.





Rather than plot the grain sizes directly, sieves are graded in size using a φ value. φ can to calculated using the formula:

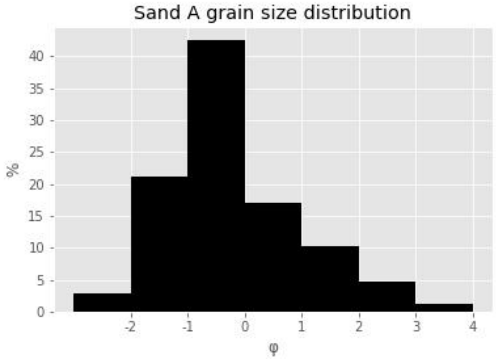
φ = - log2 (grain diameter)

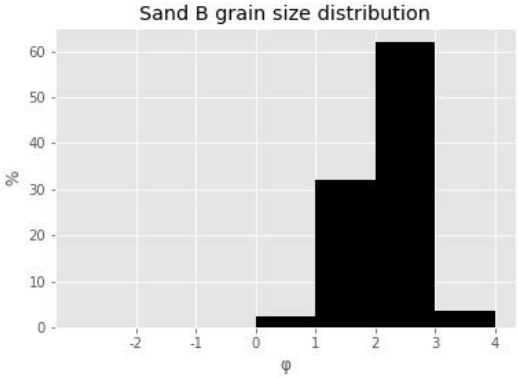
This table shows the φ values that we are using

φ values

φ	diameter (mm)
-2	4
-1	2
0	1
1	0.5
2	0.25
3	0.125
4	0.0625

So the two graphs look like this:





We calculate the mean grain size by adding sieve size x percentage for each sieve and dividing by the total (= 100). My calculations make sand A mean = 1.08mm and B mean = 0.171mm.

Sand A is more poorly sorted than sand B (wider range of bars).

Sand A is positively skewed (tail goes out to the right), Sand B is more difficult because it only has 4 bars in its chart, but it does seem to be negatively skewed (tail goes out to the left).

Sand A has much bigger fragments (up to 4mm) in it which might make it a better candidate for a river sand. The beach sand would have a smaller range of grain size.