

Problem Set 1

UN0701 – Engineering Risk and Reliability

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- (8) 1. Consider the following three datasets:
(the datasets will be available electronically on the course website)

Time to Failure of Diesel Engines (hours)

813	380	952.65	8.82	861.93	412.03	124.09	2.34	151.44	895.8
0.78	84.09	216.4	855.95	1885.22	163.95	1296.93	646.01	658.38	633.98
735.89	0.13	121.58	3.55	672.87	1057.57	298.58	470.97	54.85	656.04
862.93	62.09	39.1	393.37	678.13	29.75	1407.52	2959.47	14.29	85.28

Wood Beam Strength (MPa)

10.25	13.45	15.01	16.29	17.88	23.8	25.18	28.69	29.78	29.92
29.92	30.2	30.87	32	32.12	32.47	32.66	35.37	36.74	38.92
40.62	41.26	41.8	42.53	43.22	44.22	44.33	46.68	49.1	49.44
50.9	53.48	54.73	61.08	15.54	17.37	21.73	24.88	32.96	35.32
36.55	38.69	41.15	42.03	42.4	43.37	44.37	47.39	48.97	52.6

Annual Maximum Earthquake Magnitudes in Japan (1962 – 2011)

7	6.3	7.38	6.2	5.8	6	7.9	6.4	7	7.1
6.6	6.5	6.5	6.2	6	6	7.7	6.4	6.2	6.9
6.7	7.7	6.9	6.2	6.3	6.8	6.4	7.4	6.8	6.4
6.3	7.6	7.5	6.9	7	6.2	6.2	7.1	6.8	6.8
7.3	8.3	7.4	7.2	6.3	6.8	7	7.1	6.9	9.1

Choose **one** of the above datasets and

- Plot a histogram of the sample data.
 - Compute the sample statistics for the data, including the mean, variance, standard deviation and the coefficient of variation.
- (8) 2. The strength of new wood (X) is modelled as a Normally distributed random variable with mean 6000 psi and standard deviation of 1200 psi.
- Compute the 5 % and 95 % percentiles of the wood strength.
 - A wood pole reaches the end of life when the wood strength falls below 60 % of the average value of 6000 psi. What is the probability of a newly installed wood pole being at the end of life?
 - In a sample of 100 poles, how many poles on average do you expect to be at end of life?
- (8) 3. The mean lifetime of stand-by diesel generators has been determined to be around 800 hours.
- Assuming the Exponential distribution for the generator lifetime, what is the probability that a diesel generator of this type will fail during a 72 hour mission?
 - How many units would you expect to fail the mission in a group of 24 diesel generators?
 - What is the probability that exactly two diesel generators will fail during the mission?
 - What is the probability that no diesel generators will fail during the mission?

