Mid-Semester

STAT309: Probability and Statistics for Engineers

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Time allowed: 2hrs

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SECTION A: Answer one question in this section.

1. The miners are out on strike, with a list of demands. Negotiators reckon that if management meets one of the demands, the probability that the strike will end is 0.85. However, if the demand is not meet, the probability that the strike will continue is 0.92. You assess that the management will agree to meet the demand as 0.3. Later you heard that the strike has ended. What is the probability that the demand was met.

2. A well is drilled as part of an oil exploration programme. The probability of the well passing through shale is 0.4. If the well passes through shale, the probability that of striking oil is 0.3. If it does not pass through shale, the probability drops to 0.1. Given that oil was found, what is the probability it did not pass through shale?

SECTION B: Attempt all questions in this section.

3. The focusing mechanism of on Ron's camera is bust, so that he can only take pictures of people at distance 2 meters, so he only take pictures of 3 people at a time. How many different pictures are possible if 9 people are present?

4. Let A be the event that a microchip is manufactured perfectly and B be the event that the is installed correctly. If $\Pr(A) = 0.98$ and $\Pr(B) = 0.93$. What is the probability that the installed chip is functions perfectly?

5. A TV manufacturer is supplied with a certain components by a specialist producer. Each incoming consignment of the components is subject to the following quality control procedure. A random sample of 10 components is individually tested. If there are one or more defective components

among the 10 tested, the entire consignment is rejected. If there are no defectives components in the sample, the consignment is accepted.

a. What is the probability of a consignment being rejected if the true proportion of the defective components are

i. 1% and

ii. 10 %

6. Beercans are randomly tossed alongside the national road, with an average frequency of 3.2 per km.

a. What is the probability of seeing no bearcans over a 5km stretch?

b. What is the probability of seeing at least one bearcans over a 200m?

8. The population variance of the amount of cool drink supplied by a vending machine is known to be $\sigma^2 = 109$ ml.

A%	z^*
90%	1.64
95%	1.96
98%	2.33
99%	2.58

i. The machine was activated 61 times, and the mean amount of cool-drink supplied on each occasion was 176 ml . Find a 95% confidence interval for the mean.

ii. What size samples are required if the estimated mean is required to be within (i) 1 ml (ii) 0.5 ml of the true value, with probability 0.99?

9. Given data on the amount of escaping hydrocarbons (**H**) as a function of the tank temperature (**T**) in Table 1 [Hint: table value is 0.5760].

i. Plot the data to show the relationship between **H** and **T** and also explain the relationship.

ii. Determine and interpret your correlation coefficient.

iii. Test for the association or correlation between the two variables at 5% level of significance.

iv. Give the regression equation $\mathbf{H}_i = \beta_0 + \beta_1 \times \mathbf{T}_i + \epsilon_i$. Find the line of the best fit. [**Hint**: find β_0 and β_1 and then substitute back into the regression equation]

v. So if **T** is 33 predict the corresponding amount of escaping hydrocarbons (**H**).

Table 1: Hydrocarbons escaping data

H	T
29	33
24	31
26	33
22	37
27	36
21	35
33	59
34	60
32	59
34	60
20	34
36	60