STAT2203: Probability Models and Data Analysis for Engineering
Assignment 3

Due by 11:00 am on Wednesday the 23rd of October, 2019
via the Electronic Assignment Submission System (62-225)

The marks for each question is indicate by the number in square brackets. There are a total of 12 marks for this assignment.

1. A pair of random variables (X, Y) has a joint probability distribution in which $X \sim \mathsf{Exp}(1)$ and the conditional probability density function of Y given $\{X = x\}$ is

$$f_{Y|X}(y|x) = \begin{cases} e^{-(y+x)}, & y \geq -x \\ 0, & \text{else.} \end{cases}$$

   (a) Determine the marginal probability density function for Y. [2]

   (b) Using the fact that $\mathbb{E}[XY] = \mathbb{E}[X\mathbb{E}[Y|X]]$, compute the covariance between X and Y. [2]

2. A 2010 study examined students' perceptions about the use of video games in the classroom. 200 students were surveyed (103 females, 97 males) from flemish secondary schools.

   (a) Male students spent an average 6.96 hours per week playing video games with a sample standard deviation of 6.42 hours per week. Female students spent an average 2.16 hours per week playing video games with a sample standard deviation of 4.55 hours per week. Construct a 99% confidence interval for the difference in mean time spent playing video games between males and females. [1]

   (b) The students were asked their opinion on whether video games would be useful in the classroom. The students' response was given on a scale of 1 – 5 with 1 indicating strong disagreement and 5 indicating strong agreement. The average response from male students was 2.92 with a sample standard deviation of 1.05, whereas the average response from female students was 2.74 with a sample standard deviation of 0.94. Is there any evidence of a difference in the mean reponse between male and female students? State the null and alternative hypotheses, and use an appropriate test statistic to determine the P-value. What do you conclude? [3]

   (c) The students were also asked about how frequently they played video games. 21.4% of female students and 11.3% of male students replied that they did not play video games. Construct a 95% confidence interval for the difference in the proportion of male and female students that do not play video games. [1]

(d) The students preferred medium for playing video games is recorded in the table below. Is there any evidence of an association between gender and preferred medium for playing video games? State the null and alternative hypotheses, and use an appropriate test statistic to determine the P-value. What do you conclude? [3]

	Console	Portable device	Computer	Other
Female	13	6	36	26
Male	26	7	43	10

Total [12]