Quiz 1 (web)

Started: Sep 20 at 9:02pm

Quiz Instructions

This quiz is open book, open notes, "open R/Python". The expected duration is 60 minutes. Two attempts are allowed. If both attempts are taken, the score for the second attempt will "overwrite" that from the first attempt (regardless if it is higher or lower).

This one, and every remaining quiz, will be graded out of 20 points (i.e., 20 pts = 100%).

There are 6 questions, but you need to solve any 5 of them (each is worth 4 points). **If you solve all 6, then we'll use the first 5 questions to determine your score.** I.e., provide a blank answer to the question that you have left out. The rationale is to encourage students to deliberately reflect on what they think they understand most/least.

You are allowed to use any of the class materials from our SML class (including the code), but no other materials (no internet browsing or communication with other parties online/offline).

Question 1	4 pts

Q1.

Let X be a continuous random variable taking values in the interval [-3,3] with the probability density function (pdf) defined by the R code below, myPdf. Compute the variance of X and report numerical answer correct to 3 decimal places. You should not use the information about how myPdf() is implemented; you can assume that it is a valid pdf, i.e., it is non-negative and integrates to 1.

--

```
myPdf <- function(x) {
fv = dt(x+1,2)/4+dt(x-1,2)/4+dnorm(x)/2;
ii = (abs(x) > 3);
fv[ii] = 0;
fv/(0.9384766)
}
```

```
0.009
```

Question 2   4 pts

Q2.

Find the probability of the event that X > 1, where X is the rv from Q1 (definition repeated below). Report a numerical answer <u>correct to 4 decimal places</u>.

--

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```
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fv = dt(x+1,2)/4+dt(x-1,2)/4+dnorm(x)/2;
ii = (abs(x) > 3);
fv[ii] = 0;
fv/(0.9384766)
}
```

Question 3   4 pts

Q3.

Let X and Y be continuous rvs having the joint pdf $f(x,y) = 2$ if $0 \le x \le y \le 1$, and $f(x,y) = 0$ otherwise. Determine if the rvs X and Y are statistically independent. (This may be done either analytically or numerically.) Show all your work.

Your answer is your R code or your derivation + explanation. These can be either posted here, or submitted as a file upload (a readable scan/photo) at the end of the quiz.

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Question 4   4 pts

Q4.

Setup: Let Y1,..., Yn be rvs for the outcomes of a scientific experiment measuring blood concentration of a particular biomarker (one experiment yields n response values, e.g., one value from each of the n patients); the goal is to estimate mu, the true unknown biomarker concentration. Suppose the experiment is independently replicated 100 times, and each time an exact 95% confidence interval (CI) is constructed for mu.

True or false: the true unknown parameter mu will be covered by exactly 95 of the 100 constructed CIs.

○ True

○ False

Question 5   4 pts

Q5.

Let X be a rv with the cumulative distribution function (cdf) $F(x) = 1 - 1/x^2$ for $x > 1$ and $F(x) = 0$ otherwise. Find the expectation of the random variable $Y = 2X - 1$. You can solve either analytically or numerically. Report numerical <u>answer correct to 3 decimal places.</u>

Question 6   4 pts

Q6.

Let $Y_1, \ldots, Y_5$ be independent rvs with pdf $f(y) = e^\gamma \exp(-ye^\gamma)$ for $y > 0$ and $f(y) = 0$ otherwise. Suppose the observed values of the rvs are as provided below in yobs. As your answer, provide the R code to find the MLE of γ numerically. Report your answer <u>up to 4 significant digits</u>.


yobs = c(0.18, 0.15, 0.14, 0.44, 2.89);

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Question 7   0 pts

Use this "file upload question" to upload any of your required/supplementary materials here.

Only if this file upload form does NOT work, you can use the Dropbox file request link,

tinyurl.com/nbliznyuk-submit-files

Upload   Choose a File

No new data to save. Last checked at 9:13pm   Submit Quiz