2.086 Numerical Computation for Mechanical Engineers

MINI-QUIZ 2 — Fall 2014

You may refer to the textbook, lecture notes, MATLAB® tutorials, and other class materials as well as your own notes and scripts.

You may use a calculator (for simple arithmetic operations and function evaluations). However, laptops, tablets, and smartphones are not permitted.

You have 30 minutes of recitation to complete the mini quiz. When you are finished, you can hand in your quiz and start working on your assignment.

NAME _____

There are a total of 100 points: four questions, each worth 25 points.

All questions are multiple choice; *circle one and only one answer.*

We provide two blank pages at the end of the quiz which you may use for any derivations, but note that we will *only grade your multiple choice selections*.

This (same) quiz will be administered in all recitation sections. *You may not discuss this quiz with other people until the graded quizzes are returned to the class.*

Question 1 (25 points). A student takes the bus to school every day. In a *model* of this process, the "bus arrival" variable (B) can have two possible outcomes: on time ($B = OT_B$) and late ($B = L_B$). The "student arrival" (to the bus stop) variable (S) can have three possible outcomes: early ($S = E$), on time ($S = OT_S$) and late ($S = L_S$). The student successfully catches the bus when he arrives at the bus stop before the bus or at the same time as the bus; in particular, note that when both the bus and the student are late ($S = L_S$ and $B = L_B$), under this model, the student catches the bus.

Which of the following statements is <u>not</u> correct?

(a) The event "student catches the bus" and the event "student misses the bus" are mutually exclusive.

(b) The event "student catches the bus" and the event "student misses the bus" are collectively exhaustive.

(c) The outcome "student is late" and the event "student catches the bus" are mutually exclusive.

(d) The outcome "student is late" and the event "student catches the bus" are collectively exhaustive.

You may find the following diagram useful for constructing the sample space.

		student		
		$S = E$ (early)	$S = OT_S$ (on time)	$S = L_S$ (late)
bus	$B = OT_B$ (on time)			
	$B = L_B$ (late)			

Question 2 (25 points). This question is based on Question 1. Over a period of time leading to n observations, we find that $\varphi_n(S = E) = 0.05$ and $\varphi_n(S = OT_S) = 0.25$, where φ_n is the frequency function. If $\varphi_n(\text{event} \equiv \{\text{student missed the bus}\}) = 0.35$, then, the value of $\varphi_n(\text{event} \equiv \{S = L_S \cap B = L_B\})$ is

(a) 0.35

(b) 0.50

(c) 0.70

(d) 1.0

You may find the following diagram useful for constructing the sample space.

		student		
		$S = E$ (early)	$S = OT_S$ (on time)	$S = L_S$ (late)
bus	$B = OT_B$ (on time)			
	$B = L_B$ (late)			

Question 3 (25 points). Consider rolling two fair dice simultaneously and independently. Let D_1 and D_2 denote the result — the number of dots on the face that lands "up" — of the first and second die, respectively. You may assume that each of the $6^2 = 36$ possible outcomes is equally likely: each outcome occurs with probability 1/36. If this process (rolling two dice simultaneously) is repeated a large number of times (n), then $\varphi_n(\{D_1 + D_2 \leq 5\} \cup \{D_1 = 1\})$ will approach

(a) 0.4444

(b) 0.1667

(c) 0.3333

(d) 0.1111

Question 4 (25 points). A student is experimenting with a "loaded" coin and finds that, when tossed a *very large* number of times, it gives Heads with relative frequency (number of times the event is observed divided by total number of experiments) 60%. Considering now the outcomes of two consecutive (and independent) tosses of the same coin (i.e., the sample space of possible outcomes is $\{HH, HT, TH, TT\}$), the probability of obtaining Heads twice (HH) is:

(a) 0.60

(b) 0.50

(c) 0.40

(d) 0.36

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