

Name: _____ Net ID: _____
Last First

Instructions:

1. *PRINT YOUR NAME and NET ID in the space provided in the upper left corner.*
 2. *Submit electronic copy in Canvas (**PDF file only**).*
 3. **Show ALL WORK.** *Partial credit will be awarded, but only if relevant equations are shown. (For multiple-choice and fill-in-blank questions, only the final answer is required.)*
 4. *Total 6 questions. Total possible points: 100.*
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1. Plastic parts produced by an injection-molding operation are checked for conformance to specifications. Each tool contains 32 cavities in which parts are produced, and these parts fall into a conveyor when the press opens. Four cavities are affected by a temperature malfunction that results in parts that do not conform to specifications.

An inspector selects 5 parts without replacement from among the 32 at random.

(a) [5 points] Let C represent a conforming part and N represent a nonconforming part (e.g., $2C3N$ means 2 conforming parts and 3 nonconforming parts, for a total of 5 parts in the sample).

Please write down the complete sample space for this random experiment/sampling process.

$S = \{ \hspace{15em} \}$

(b) [5 points] How many samples contain exactly two conforming parts?

(c) [5 points] How many samples contain at least one nonconforming part?

2. [5 points] Suppose that an operating room needs to handle three knee, four hip, and five shoulder surgeries. How many different schedules begin and end with a knee surgery?

3. Fill in the blanks.

A Web ad can be designed from four different colors, three font types, five font sizes, three images, and five text phrases. A specific design is randomly generated by the Web server when you visit the site. Let A denote the event that the design color is red, and let B denote the event that the font size is not the smallest one.

Calculate the following probabilities. (Two decimal places.)

(a) [5 points] $P(A) =$ _____

$P(B) =$ _____

$P(A \cap B) =$ _____

(b) [5 points] $P(A \cup B) =$ _____

(c) [5 points] $P(A' \cup B') =$ _____

4. A maintenance firm has gathered the following information regarding the failure mechanisms for air conditioning systems:

		Evidence of Gas Leaks (L)		Total
		Yes	No	
Evidence of electrical failure (F)	Yes	55	17	72
	No	32	3	35
Total		87	20	107

The units without evidence of gas leaks or electrical failure showed other types of failure. If this is a representative sample of AC failure:

(Round answers to **four decimal places**.)

(a) [**4 points**] Find the probability of gas leaks.

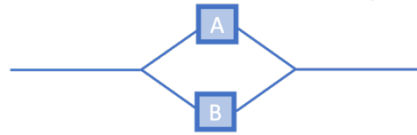
(b) [**4 points**] Find the probability that the failure involves a gas leak.

(c) [**4 points**] Find the probability that there is evidence of electrical failure given that there was a gas leak.

(d) [**4 points**] Find the probability of electrical failure.

(e) [**4 points**] Find the probability that there is evidence of a gas leak given that there is evidence of electrical failure.

5. A system contains two components, A and B, connected in parallel as shown in the diagram.

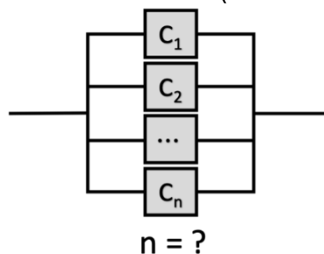


Assume A and B function independently.

(a) [5 points] If the probability that A fails is 0.08 and the probability that B fails is 0.12, what is the probability that the system functions? (Round answer to **four decimal places**.)

(b) [5 points] If both A and B have probability p of failing, what must the value of p be so that the probability that the system functions is 0.9? (Round answer to **four decimal places**.)

(c) [10 points] If components function independently, and each component has probability 0.4 of failing, what is the minimum number of components that must be connected in parallel so that the probability that the system functions is at least 0.99? (Round up the answer to a **whole number**.)



6. The British government has stepped up its information campaign regarding foot-and-mouth disease by mailing brochures to farmers around the country.

It is estimated that 99% of Scottish farmers who receive the brochure possess enough information to deal with an outbreak of the disease, but only 70% of those without the brochure can deal with an outbreak.

After the first three months of mailing, 85% of the farmers in Scotland had received the informative brochure.

(Round answer to **four decimal places**.)

(a) [5 points] Fill in the blanks.

Let B represent the event that a farmer received the brochure, and B' represent the event that a farmer didn't receive a brochure.

Let O represent the event that a farmer can handle a disease outbreak, and O' represent the event that a farmer cannot handle a disease outbreak.

Use appropriate probability notations to express the given probabilities in the question.

$$e.g., P(B) = 85\%$$

$$\underline{\hspace{2cm}} = 99\%$$

$$\underline{\hspace{2cm}} = 70\%$$

(b) [10 points] Compute the probability that a randomly selected farmer will have enough information to deal effectively with an outbreak of the disease.

(Hint: total probability rule.)

(c) [10 points] Given the randomly selected farmer cannot deal with an outbreak of the disease, what is the probability that this farmer has not received the informative brochure?

(Hint: Bayes' Theorem.)