

Name: _____

INSTRUCTIONS

1. Nonprogrammable calculators (or a programmable calculator cleared in front of the professor before class) are allowed. Exam is closed book/closed notes.
2. There are 4 pages front and back for the exam in addition to the cover sheet.
3. You may leave answers in fractional form or provide three (3) decimal places.
3. Work is required to receive credit. Partial credit will be given for work that is partially correct. Points will be deducted for incorrect work even if the final answer is correct.
4. If we cannot read your work, it will be marked wrong.
5. Please attach all scrap paper to the exam.
6. Good Luck!

Page	Possible	Score
3	22	
4	32	
5	26	
6	24	
Total	104	

Note: This includes 4 points bonus. The Midterm is out of 100 points.

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(5 pts.) 1. Please write a question asking for the following sample space and event A in complete English sentences: $S = \{1, \dots, 52\}$, $A = \{x|x \text{ is even}\}$

(10 pts.) 2. In a study of pleas and prison sentences, it is found that 40% of the subjects studied were sent to prison. Among those sent to prison, 35% plead guilty. Among those not sent to prison, 55% plead guilty. If a person in this study was selected at random and entered a guilty plea, what is the probability that they were **NOT** sent to prison.

(7 pts.) 3. A class consists of 35 students of which 17 are boys and 18 are girls. If you select 4 students at random for a group, what is the probability that the first 3 are girls and the last one is a boy?

(23 pts.) 4. The following table gives the probabilities for favorite winter sport for 401 middle school students:

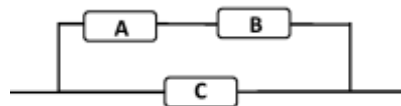
Grade	Sledding	Cross Country Skiing	Ice Skating	Reading	TOTAL
6 th	0.13	0.06	0.08	0.04	0.31
7 th	0.12	0.07	0.11	0.07	0.37
8 th	0.07	0.10	0.09	0.06	0.32
TOTAL	0.32	0.23	0.28	0.17	1.00

a) What type of probability is this? Please briefly explain your answer.

b) Assuming that the student is a 6th grader, what is the probability that the student does **NOT** prefer sledding?

c) Assuming that the student is **NOT** a 6th grader, what is the probability that the student prefers sledding?

(9 pts.) 5. In the following circuit, all of the components are independent of each other. The probability that each of the components fails is 0.1. What is the probability that the circuit will succeed?



(26 pts.) 6. In a kindergarten class, the children like two types of candy, lollipops and bubble gum. In this class, 36% of the children like bubble gum, 12% like both of the types of candy and 23% of the children don't like either of these types of candy. A child is chosen at random.

a) What is the probability that the child likes at least one of the types of candy? Hint: Shade in what the 23% represents on a Venn diagram.

b) What is the probability that the child likes lollipops?

c) What is the probability that a child likes bubble gum but does NOT like lollipops?

d) Is the fact that a child likes lollipops independent of the fact that a child likes bubble gum? There will be no credit unless a correct explanation is provided.

(7 pts.) 7. Prove the following statement: $P(A^c) = 1 - P(A)$. Each step must have an explanation of either one of Axioms or a definition. No theorems are allowed. Hint: Rearrange the equation.

(10 pts.) 8. A meteorologist records whether it snows or not on 4 successive days in winter.

a) Using set theory notation, what is the sample space for this situation?

b) Using set theory notation, describe the event that it does snow for the first two days.

(7 pts.) 9. If two events, A and B, are disjoint, is it possible for them to also be independent if $P(A) \neq 0$ and $P(B) \neq 0$? Use mathematical reasoning to explain your answer, that is, you cannot provide an example or counter-example to explain your choice but need to use mathematical equations.