Name:

Special Notes:

1. You may use an 8×11 piece of paper for the formulas.

2. You may use a simple calculator. No internet.

3. This is a 3 hr exam.

Honor Code: By signing my name below, I pledge my honor that I have not violated the Booth Honor Code during this examination.

Signature:

GOOD LUCK!!

Problem A. True or False: Please Explain your answers in detail. Partial credit will be given (50 points)

1. The Illinois state lottery introduces a new game. The numbers 1 to 20 are drawn at random without replacement (no two numbers can be the same). You win if you correctly identify all four numbers in exact order. The probability that you win is 1 in $124,750$.

2. The following data on age and martial status of 140 customers of a Bondi beach night club were taken

Age	Single	Married
Under 30	77	14
Over 30	28	21

Given this data, age and martial status are independent.

3. If $P(X|Y) = 0.5$ and $P(Y) = 0.5$, then we must have $P(X) = 0.5$

4. Suppose that there's a 5% chance that it snows tomorrow and a 80% chance that the Chicago bears play their football game tomorrow given that it snows. The probability that they play tomorrow is then 80%.

5. Suppose that a random variable X can take the values $\{0, 1, 2\}$ all with equal probability. Then the expected and variance of X are both 1.

6. A mortgage bank knows from experience that 2% of residential loans will go into default. Suppose it makes 10 such loans, then the probability that at least one goes into default is 95%.

7. Arsenal are playing Burnley at home in an English Premier League (EPL) game this weekend. They are favourites to win. They have a Poisson distribution for the number of goals they will score with a mean rate of 2.5 per game. Given this, the odds of Arsenal scoring at least two goals is greater than 50%.

8. A local bank experiences a 2% default rate on residential loans made in a certain city. Suppose that the bank makes 2000 loans. Then the probability of more than 50 defaults is 25 percent.

9. Given a random sample of 2000 voters, 800 say they will vote for Hillary Clinton in the 2016 US Presidential Election. At the 95% level, I can reject the null hypothesis that Hillary has an evens chance of winning the election.

Problem B: Bayes (20 points) Seventy percent of the light aircraft that disappear while in flight in a certain country are subsequently discovered. Of the aircraft that are discovered, 60% have an emergency locator, whereas 90% of the aircraft not discovered do not have such a locator. Suppose that a light aircraft has disappeared. If it has an emergency locator, what is the probability that it will be discovered?

Problem C: A/B Testing. (20 points)

On September 24, 2003, Pete Thamel in the New York Times reported that the Boston Red Sox had been accused of cheating by another American League Team. The claim was that the Red Sox had a much better winning record at home games than at games played in other cities.

The following table provides the wins and losses for home and away games for the Red Sox in the 2003 season

Team	Record			
	Home Wins	Home Losses	Away Wins	Away Losses
Boston Red Sox	53	28	42	39

Is there any evidence that the proportion of Home wins is significantly different from home and away games?

Problem D: Match the Distribution (20 points) A super market carried out a survey and found the following probabilities for people who buy generic products depending on whether they visit the store frequently or not

Visit	Purchase Generic		
	Often	Sometime	Never
Frequent	0.10	0.50	0.17
Infrequent	0.03	0.05	0.15

1. What is the probability that a customer who never buys generics visits the store?

2. What is the probability that a customer often purchases generic?

3. Are buying generics and visiting the store independent decisions?

4. What is the conditional distribution of purchasing generics given that you frequently visit the store?