

Midterm (75 minutes)

No calculators allowed. Just set up your answers, for example,  $P = 49/52$ . BE SURE TO EXPLAIN YOUR REASONING. If you want extra time, you can buy time at a price of 1 point a minute; for example, if your test is handed in 10 minutes after the scheduled finish time, 10 points will be subtracted from the test score.

1. Answer the following question, asked of Marilyn Vos Savant:

My dad heard this story on the radio. At Duke University, two students had received A's in chemistry all semester. But on the night before the final exam, they were partying in another state and didn't get back to Duke until it was over. Their excuse to the professor was that they had a flat tire, and they asked if they could take a make-up test. The professor agreed, wrote out a test and sent the two to separate rooms to take it. The first question (on one side of the paper) was worth 5 points, and they answered it easily. Then they flipped the paper over and found the second question, worth 95 points: 'Which tire was it?' What was the probability that both students would say the same thing? My dad and I think it's 1 in 16. Is that right?

2. "The Census Bureau reported that in 2009 there were 197 million white Americans and that there were a total of 304 million people of which 149 million were male. Since 49.0% of the population was male, I multiplied this percentage by 197 million to determine the number of white males." What assumption is needed for this calculation to be right? (Explain your reasoning.)
- independence.
  - mutually exclusive.
  - law of large numbers.
  - central limit theorem.
3. English soccer clubs playing in the Premier League are given 3 points for a win, 1 point for a tie, and 0 points for a loss. A researcher assumed that, because the teams are evenly matched, win, loss, and draw are equally likely, so that the expected number of points from a game is  $\mu = 3(1/3) + 1(1/3) + 0(1/3) = 1.33$ . Use an example to explain why his assumption is not warranted.
4. A researcher found that in the 2009-2010 Premier League season, the soccer teams with the best records tended to win more of their home games than did teams with worse records. He concluded that this demonstrated the importance of a home-field advantage. Why do his data not justify his conclusion?

5. Use a boxplot to summarize the U.S. dollar prices of Big Mac hamburgers in 20 countries.

	in Local Currency	in US dollars
United States	\$ 3.41	3.41
Argentina	Peso 8.25	2.63
Australia	A\$ 3.45	3.09
Brazil	Real 6.9	3.95
Britain	£ 1.99	3.90
China	Tuan 11	1.51
Egypt	Pound 9.54	1.73
Euro area	€ 3.06	4.54
Hong Kong	HK\$ 12	1.54
Indonesia	Rupiah 15900	1.70
Japan	¥ 280	2.58
Mexico	Peso 29	2.65
Norway	Kroner 40	7.58
Pakistan	Rupee 140	2.23
Philippines	Peso 85	2.09
Russia	Rouble 52	2.14
Saudi Arabia	Riyal 9	2.40
South Africa	Rand 15.5	2.29
South Korea	Won 2900	3.09
Taiwan	NT\$ 75	2.32

6. One measure of the performance of stock portfolio managers is  $U = \frac{\frac{m}{n} - 0.5}{\sqrt{0.5(0.5)/n}}$ , where  $n$  is the number of

years being studied and  $m$  is the number of years that the manager has done better than the median manager. Explain in simple English what  $U = -0.8$  means.

7. Rupert Murdoch's News Corp reported a profit (millions of Australian dollars) of 364.364 in 1987, 464.464 in 1988, 496.496 in 1989, and 282.282 in 1990, If the last 3 digits were randomly determined, what is the probability that the last three digits will match the first 3 digits every year for 4 consecutive years?

8. Suppose that 90% of all stock market forecasters are guessers, with a 50% chance of correctly predicting whether the stock market will do better or worse than the bond market in the coming year, and that 10% of the forecasters are “experts,” with a  $\frac{2}{3}$  chance of making a correct prediction. For each group, the chances of making a correct prediction do not depend on the outcomes of other predictions. If a forecaster predicts 6 out of 9 years correctly and 3 incorrectly, what is the probability this forecaster is an expert?
9. Explain why you either agree or disagree with each of these statements:
- “If I flip a fair coin until I obtain a heads, on average, it will take me two flips.”
  - “The average absolute deviation is less sensitive to outliers than is the standard deviation.”
  - “If the expected value of the change in income is zero, then the change is equally likely to be positive or negative.”
  - “The probability of 5 heads when a coin is flipped 10 times is larger than the probability of 2 heads when a coin is flipped 4 times.”
10. Explain why you either agree or disagree with each of these statements:
- “The central limit theorem explains why a binomial distribution with  $\pi = 0.9$  converges to a normal distribution as  $n$  increases.”
  - “For a normal distribution, there is a 0.95 probability of being within two standard deviations of the median.”
  - “The width of the box in a box plot is equal to the interquartile range.”
  - “The probability of four 2s when six dice are rolled can be determined by the binomial distribution.”