Professor Atkinson

1. 2-14 from BL.
2. 2-26 from BL.
3. 2-34 from BL.
4. 2-41 from BL.
5. 2-42 from BL.
6. 2-R1 from BL.
7. 2-R5 from BL.
8. 3-10 from BL.
9. 3-11 from BL.
10. 3-19 from BL.
11. 3-21 from BL.
12. 3-23 from BL.
13. 3-24 from BL.
14. 3-25 from BL.
15. 3-26 from BL.
16. 3-27 from BL.

17. Prove or disprove: If $P(A) > P(B)$, then $P(A|C) > P(B|C)$. Assume that no event has zero probability.

18. Prove or disprove: If $A$ and $B$ are independent, then $P(AB|C) = P(A|C)P(B|C)$.

19. Let the probability distribution of $(X,Y)$ be given by

<table>
<thead>
<tr>
<th>Y</th>
<th>1</th>
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<tbody>
<tr>
<td>X</td>
<td>1</td>
<td>1/2</td>
<td>1/2</td>
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<tr>
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<td>2</td>
<td>4/8</td>
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Find $V(X|Y)$.

20. Let the probability distribution of $X$ be given by

$$f(x) = \begin{cases} x & \text{for } 0 < x < 1 \\ 2 - x & \text{for } 1 < x < 2 \\ 0 & \text{otherwise} \end{cases}$$

Compute $V(X)$.  

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21. Let $(X, Y)$ have joint density $f(x, y) = 2$, $0 < x < 1$ and $0 < y < x$. Compute $V(X)$ and $\text{COV}(X,Y)$.

22. Assume that $X$ and $Y$ are independent with $E(X) = 4$, $V(X) = 2$, $EY = 1$, and $V(Y) = 1$. Define $Z = X + Y$ and $W = XY$. Compute $\text{COV}(Z,W)$.

23. Assume that you are solving the three doors problem discussed in class.
   a. Compute the probability of winning given that you always stay with your first choice versus the probability of winning given that you always switch. Refer to class notes.
   b. Find a partner and perform this experiment 20 times using the first strategy and 20 times using the second strategy. Record the outcome of each experiment on a paper that you attach. Compute the probabilities of each strategy from this data.

24. Let $H=$Heart Attack and $C=$High cholesterol. Your are told that 85% of people with a heart attack have high cholesterol. What is the probability of a heart attack given high cholesterol? Find data on the internet to use along with the 85% figure in this calculation.

25. You are concerned about developing Alzheimer’s so you send a swab of your cheek and $150 to Ancestry.com for a DNA analysis. They tell you that you have “two markers (2M) in common with people who have Alzheimer’s (A)”. Assume that the analysts took DNA samples from people with Alzheimer’s to determine their genetic makeup. Answer the following:
   a. Does having two markers in common with Alzheimer’s patients tell you the $P(2M|A)$? (Remember that many Alzheimer’s patients will not have these two markers.)
   b. Assume that you know $P(2M|A)$. Remember that many people with both markers never develop Alzheimer’s. What probability do you ultimately want and what other probabilities do you need in addition to $P(2M|A)$ to make this computation?

To get more information on genetic markers and Alzheimer’s, Google on this topic. Look at the Mayo Clinic web site:

http://www.mayoclinic.org/diseases-conditions/alzheimers-disease/in-depth/alzheimers- genes/art-20046552