**Problem 1.** [15] Reasoning with a Joint Probability Table

The following table gives probabilities for three Boolean random variables, *X*, *Y*, and *Z*:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | *Y* | | ¬*Y* | |
| *Z* | ¬*Z* | *Z* | ¬*Z* |
| *X* | 0.70 | 0.015 | 0.10 | 0.02 |
| ¬*X* | 0.08 | 0.01 | 0.07 | 0.005 |

1. [4] What is *P*(*Y* | *X*)? Show your work.

*P*(*Y*|*X*) = (0.70+0.015)/(0.70+0.015+0.10+0.02) = 0.856

1. [4] What is *P*(*Y*)? Show your work.

*P*(*Y*) = (0.70+0.015+0.08+0.01)/(0.805+0.195) = 0.805

1. [4] What is *P*(*X*, *Z*)? Show you work.

*P*(*X*,*Z*) = (0.70+0.10)/(0.70+0.10+0.015+0.02+0.08+0.07+0.01+0.005)

= 0.80

1. [4] Is the data consistent with *X* and *Z* being independent? Briefly explain.

Since *P*(*X*)= 0.835, *P*(*Z*)= 0.95, and *P*(*X*)\**P*(*Z*) ≠ *P*(*X*,*Z*), so the data is not consistent with *X* and *Z* being independent.

**GRADING:**

* **4 points for each correct answer**
* **1 point if answer is incorrect but question is attempted**

**Problem 2.** [20] Using a Bayesian Network

1. [5]

= 0.1818

**GRADING:**

* **5 points for each correct answer**
* **1 point if answer is incorrect but question is attempted**