

Homework 1: Probability and Bayesian networks

Total points: 70.

We only accept electronic submission. Please try to ask questions on Piazza first.

For questions in this homework, we are going to take the perspective of an instructor who wants to determine whether a student has understood the material, based on the exam score. Figure 1 gives a Bayesian network for this.

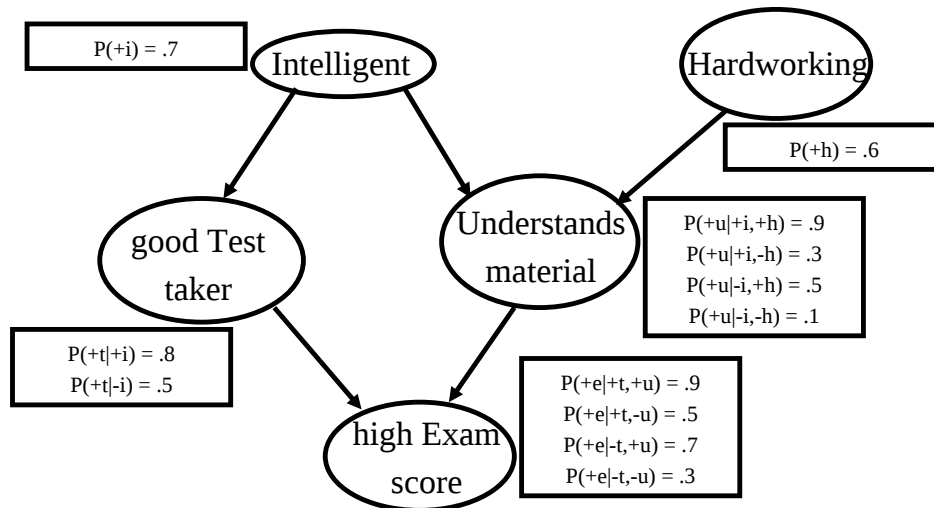


Figure 1: A Bayesian network representing what influences an exam score.

As you can see, whether the student scores high on the exam is influenced both by whether she is a good test taker, and whether she understood the material. Both of those, in turn, are influenced by whether she is intelligent; whether she understood the material is also influenced by whether she is a hard worker.

Problem 3 (40 points.) For the above Bayesian network, label the following statements about conditional independence as true or false. For this question, you should consider only the structure of the Bayesian network, not the specific probabilities. **Please show all five steps taught in the class, otherwise no partial score will be given.**

1. T and U are independent.
2. T and U are conditionally independent given I , E , and H .
3. T and U are conditionally independent given I and H .
4. E and H are conditionally independent given U .

5. E and H are conditionally independent given U , I , and T .
6. I and H are conditionally independent given E .
7. I and H are conditionally independent given T .
8. T and H are independent.
9. T and H are conditionally independent given E .
10. T and H are conditionally independent given E and U .

Problem 4 (30 points).

Using variable elimination (by hand!), compute the probability that a student who did well on the test actually understood the material, that is, compute $P(+u | +e)$.