You are manager of ACME Incorporated, which is preparing to deliver a wind turbine to one of its vendor

The vendor will take one week to determine whether the turbine meets the requirements (OK) or if additional work is needed to meet specification (NOK)

ACME incorporated has two options to deliver the turbine to the vendor. Option 1 is to deliver turbine to customer directly. Option 2 is to put the turbine through lots of rework before delivery.

If ACME chooses Option 1 to deliver turbine to vendor directly and it works as intended, they will make $31,000 in profit. However if vendor says the turbine fails and does not meet requirements, it will take ACME 5 weeks to fix the machine at vendors location. This will result in $9,000 net loss on the sales.

If Acme chooses Option 2, and puts the turbine through lots of rework before delivering it to the vendor this will cause a extra expense and reduce their profit to $16,000 if the turbine works properly as intended. However if after the rework is done and the turbine fails to meet vendor requirements, it will the take two days to repair the turbine at the vendor site, which will result in a $10,000 profit for ACME.

If ACME delivers the turbine to the vendor directly, there is a 0.60 probability of the turbine meeting requirements successfully

If rework is completed before delivery, there is a 0.95 probability of meeting requirements successfully.

Questions

1. Explain what the decision alternatives are for the above situation? What are the states of nature?
2. Create the decision tree and report Each of the decision alternatives and the expected values for each alternative
3. Parameters in ACME are uncertain. For instance, the probabilities of the wind turbines meeting specifications that are delivered directly or after rework could be much different from the estimate values mentioned above even though both of these probabilities have historically been more than 50%. What would you as the manager of ACME recommend the company to do in regards to these uncertainties? Explain these probabilities.

**Follow On Questions**

ACME can perform a diagnostic test to determine whether the turbine will meet customer requirements before the turbine is delivered directly to the vendor. The Test would cost ACME $2,000 and has two possible outcomes Compliant (C) or Unacceptable (U). Based on historical trends, the Test does a better job of recognizing whether the turbine meets specifications. ACME estimates the Test will correctly identify a turbine that meets the requirements 90% of the time. However the Test, will also falsely claim that the turbine meets requirements 25% of the time.

However if ACME decided to do the extensive rework after the test instead of delivering to the vendor directly, the test will not affect the probability of the machine meeting customer requirements. In other terms, the probability of the machine is okay (OK) after rework is not affected by the test outcome (still 95%).

1. Describe the reliability values of the test in Pr(A|B) format
2. Calculate all the marginal probabilities of the Test outcome being Compliant (C) or Unacceptable (U).
3. Calculate the updated probabilities of the turbine meeting requirements without rework, given the Test being Compliant (C) or Unacceptable (U).
4. Build a decision tree and identify the best alternatives under the Test results being Compliant (C) or Unacceptable (U). Describe the best alternative
5. Make a comment on the value of the Test for ACME to reflect on.