Part 2 Extra Examples

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Example 1.
Imagine we are crime scene investigators, investigating a murder case. We wish to determine how the victim was killed.

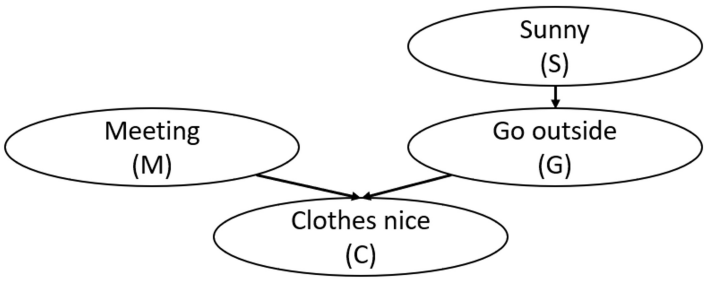
Assume all victims of murder are killed by poison or blunt-force. From our extensive prior knowledge as investigators, we know 60% of murders happen by poison and 40% of murders happen by blunt-force.

If a murder is by poison, there is a 10% chance of blood. If a murder is by blunt-force, there is a 90% chance of blood.

Suppose we observe blood at the scene of the crime. What is the probability the victim was murdered by poison vs. blunt-force?

Example 2.
Consider the situation of choosing an outfit to wear during working from home. This is described by the following Bayesian network. Assume each variable in the network can take on value true or false.

Compute an expression for the probability P(M = true | C = true) using the variable elimination algorithm.



Example 3.
Consider the rule-based system given below.

IF A and B THEN diagnosis is C
IF A or D THEN B
IF D or E THEN diagnosis is F
IF B and E and H THEN diagnosis is G
IF H and I THEN E

Assume the following premises are askable: A, D, H, I. If they are asked of the user, their values will be A = true, D = true, H = true, I = false.

A) Use data-driven reasoning to determine as many facts about this system as possible.
B) Use goal-based reasoning to determine the diagnosis.

Example 4.
Compute the truth value of the statement:

(A and B) or (C or D)

Assume the truth value of A = 0.4, B = 0.5, C = 0.2, D = 0.1. Use the Goguen t-norm and s-norm.

Example 5.
Consider a fuzzy rule-based system for classifying image of the ocean versus images of the forest. We used the following fuzzy rules (with Goguen t-norm):

IF blue is lots and green is little THEN image is ocean.
IF blue is little and green is lots THEN image is forest.

Suppose we have the following trapezoidal membership functions:
Blue is little: a = 0, b = 0, c = 0.2, d = 0.8
Blue is lots: a = 0.2, b = 0.8, c = 1, d = 1
Green is little: a = 0, b = 0, c = 0.3, d = 0.7
Green is lots: a = 0.3, b = 0.7, c = 1, d = 1

Suppose we input an image into our classifier with blue = 0.4, green = 0.6. Compute the membership of the input image in the ocean and forest classes.

Example 6.
Consider a fuzzy control system for determining the speed a fan in a cooling system should run at. Suppose we have the following set of rules:

IF temperature is high or humidity is high THEN fan is high
IF temperature is medium or humidity is medium THEN fan is medium
IF temperature is low and humidity is low THEN fan is low.

Temperature is measured in Celsius, and the membership functions for temperature are trapezoidal:
Temperature is low: a = 0, b = 0, c = 15, d = 20
Temperature is medium: a = 15, b = 20, c = 20, d = 25
Temperature is high: a = 20, b = 25, c = 100, d = 100

Humidity is measured in percentage, and the membership functions for humidity are trapezoidal:
Humidity is low: a= 0, b = 0, c = 30, d = 40
Humidity is medium: a = 30, b = 40, c = 40, d = 50
Humidity is high: a = 40, b = 50, c = 100, d = 100

Fan speed is measured in RPM, and the membership functions for fan speed are trapezoidal:
Fan speed is low: a = 0, b = 0, c = 800, d = 1000
Fan speed is medium: a = 800, b = 1000, b = 1000, d = 1200
Fan speed is high: a = 1000, b = 1200, c = 1600, d = 1600

Suppose we observe the temperature is 24 degrees Celsius and the humidity is 43%.

A) What is the fan speed if we use the Lukasiewicz t-norm and s-norm?
B) What is the fan speed if we use the Goguen t-norm and s-norm?