Exercise Questions: Bayesian Networks

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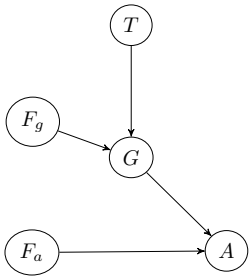
As a developer of a security equipment company, you are going to design an alarm that senses when an infra-red sensor gauge exceeds a given threshold. The infra-red sensor measures the infra-red temperature and the gauge measures the infra-red temperature obtained from the infra-red sensor. Consider the Boolean variables A (alarm sounds), F_a (alarm is faulty), F_g (gauge is faulty) and the G (gauge reading: normal and high) and T (actual infra-red temperature: normal and high).

1. Draw a Bayesian network for this problem.

   Answer:



2. Write down the joint probability distribution represented by this Bayesian network.

   Answer:

$$P(X_1, X_2, \ldots, X_n) = \prod_{i=1}^{n} P(X_i|\text{Parents}(X_i)) \tag{1}$$

$$= P(T)P(F_g)P(G|F_g, T)P(F_a)P(A|G, F_a) \tag{2}$$

3. How many parameters are required to describe this joint probability distribution? Show your working.

   Answer: The total number of parameters is

$$1 + 1 + 4 + 1 + 4 = 11$$