T-79.230 **Kevät 2005**
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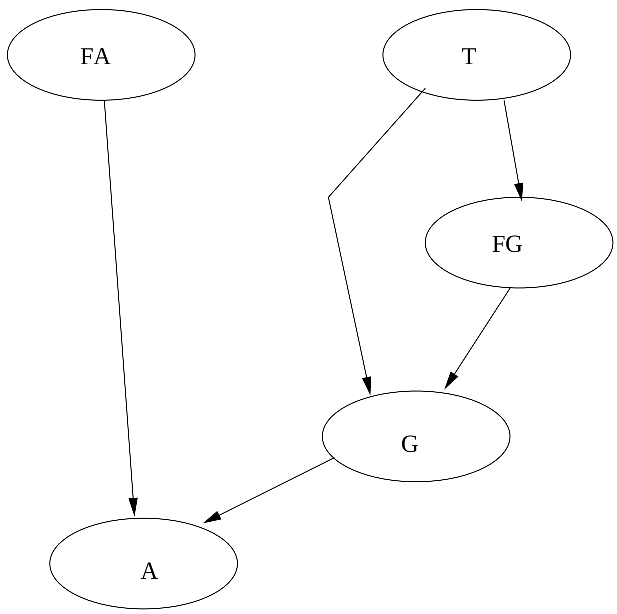
Laskuharjoitus 3
Solutions

1. (a) We start by abstracting the temperatures so that there are only two possible values, safe and dangerous.

   We use the following nodes in the network:

   - F_A — Is the alarm faulty?
   - T — Is the temperature too high?
   - F_G — Is the temperature gauge faulty?
   - G — Does the gauge show dangerous temperature?
   - A — The alarm rings.

   Using the dependencies given in the exercise text, we get the following Bayesian network:



   (b) The network is not a polytree, since there are two different routes from node T to node G.

   (c) We attach the following probability tables to nodes of the network:

T	F_G	$P(G)$
T	T	y
T	F	x
F	T	$1-y$
F	F	$1-x$

(d)

G	F_A	$P(A)$
T	T	0
T	F	1
F	T	0
F	F	0

(e) When we compute probabilities from effects to causes, we try to establish how different predecessors contribute to the probability table of a node.

$$\begin{aligned}
P(T \mid \neg F_A \wedge \neg F_G \wedge A) &= P(T \mid G \wedge \neg F_G) \\
&= \frac{P(G \wedge \neg F_G \mid T)P(T)}{P(G \wedge \neg F_G)} \\
&= \frac{P(G \mid \neg F_G \wedge T)P(\neg F_G \mid T)P(T)}{P(G \wedge \neg F_G \mid T)P(T) + P(G \wedge \neg F_G \mid \neg T)P(\neg T)} \\
&= \frac{P(G \mid \neg F_G \wedge T)P(\neg F_G \mid T)P(T)}{P(G \mid \neg F_G \wedge T)P(\neg F_G \mid T)P(T) + P(G \mid \neg F_G \wedge \neg T)P(\neg F_G \mid \neg T)P(\neg T)}
\end{aligned}$$