

Name:

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### Data Mining and Machine Learning

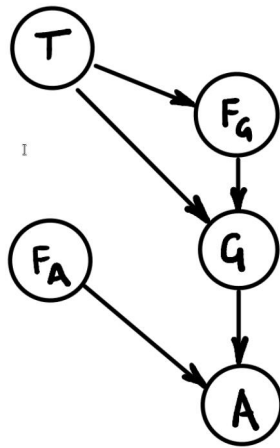
#### Quiz 3, II Semester, 2023–2024

16 April, 2024

In a nuclear power station, an alarm is triggered when a temperature gauge exceeds a given threshold. The gauge measures the temperature of the core of the reactor. Consider the boolean variables  $A$  (alarm sounds),  $F_A$  (alarm is faulty), and  $F_G$  (gauge is faulty) along with multivalued variables  $G$  (gauge reading) and  $T$  (actual core temperature).

1. Draw a Bayesian network for this scenario, given that the gauge is more likely to fail when the core temperature gets too high. Explain the structure of your network.

**Solution:**



From the situation, it is clear that  $G$  depends on  $F_G$  and  $T$  and  $A$  depends on  $F_A$  and  $G$ . The additional fact that  $G$  is more likely to fail when the core temperature gets too high justifies the edge from  $T$  to  $F_G$ .

2. Suppose  $G$  and  $T$  each take just two values, normal and high. Assume that the gauge gives the correct temperature with probability  $x$  when it is working and with probability  $y$  when it is faulty. Describe the conditional probability table for  $G$ .

**Solution:** Last column is optional.

$T$	$F_G$	$G = \text{High}$	$G = \text{Normal}$
High	Normal	$x$	$1 - x$
High	Faulty	$y$	$1 - y$
Normal	Normal	$1 - x$	$x$
Normal	Faulty	$1 - y$	$y$

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