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AAI-501
Assignment 3.1
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Instructions

In a nuclear power plant, there is an alarm that senses when a temperature gauge exceeds a given threshold. The gauge measures the temperature of the core. Consider the Boolean variables 0 or 1 for corresponding nodes A(alarm sounds), FA(alarm is faulty) and FG (gauge is faulty). Also consider the multivalued sensor nodes G(gauge reading) and T(core temperature).

Draw a Bayesian network for the alarm system. **Justify your network in detail** by explaining the connections between the nodes. FG=1 implies gauge is faulty [30 points].
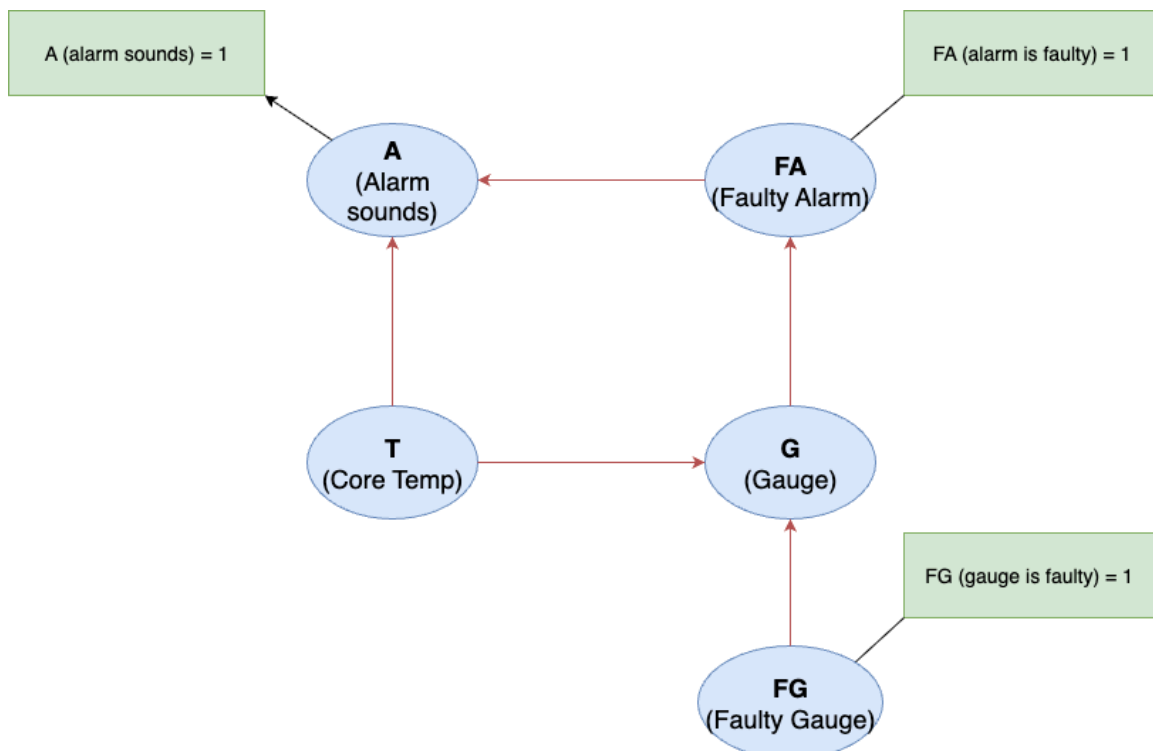
Here is the cause-effect links between nodes, based on the diagram above:

T   Core Temperature

G   Gauge

FG   Faulty Gauge

A   Alarm Sounds

FA   Faulty Alarm

T → G

The core temperature **T** causes a gauge reading **G** if the gauge is functioning properly. This is a sensor node relationship where the true state influences the measurement.

FG → G

If the gauge is faulty (**FG=1**), the reading **G** may not reflect the real temperature. This modifies the accuracy of G which represents a sensor failure scenario.

G → A

If the gauge reads a high temperature, the alarm **A** is triggered, assuming the alarm system is not faulty.

FA → A

If the alarm is faulty (**FA=1**), it might not sound even if **G** shows a high reading.

Hints: Categorize (sensor nodes versus Boolean variable nodes) Can abnormal temperatures cause the gauge to become faulty?

No, in this Bayesian network model, abnormal temperatures (**T**) are considered independent of the gauge fault status (**FG**). It means that the temperature does not cause the gauge to become faulty. Instead, the **FG** node is an independent failure variable that affects how accurately the gauge reflects the real temperature. For instance, sensor failures can result from physical deterioration, such as hardware degradation or component wear.

This aligns with the structure where **FG** and **T** are both parents of **G**, but there is no arrow from **T** to **FG**, meaning no causal effect from temperature to gauge failure.