Hypothesis 4

Prompt: Here is a description of a submarine propulsion system. Create a propositional logic system description of the form "comp0 \wedge comp1 -> obs0". Which means on the left hand side of the implication should only be components and on the right hand side should only be observations. The left-hand-side must not contain sensors. Cooling water and two types of fuel are input to the pump. After the pump comes a regulator which measures the input water flow. Following the regulator is a switch where after the switch all three values are individually measured. the water and one type of fuel go into the burner, while the second type of fuel goes through a valve and an injector, which measures the pressure. Then it also ends up in the burner. The output of the burner is pressurised steam, which goes through a seperator and a pressure sensor. It is then input into the turbine, where the revolutions per second are measured. The turbine is also connected to a generator, where power is measured. Once the steam comes out of the turbine it is input into a condenser and goes into a cooler. After the cooler the water is fed back into the input

Prompt: Describe how a hitting set is computed for fault diagnosis, when observations TurbineRPMObs and GeneratorPowerObs are faulty. Draw a graph and create python code to determine the hitting set.

Prompt:
Using the definitions of Judea Pearl, create a structural causal model of the Tennessee Eastman Process. The Tennessee Eastman Process is a standard process in the process industry. We want to use the structural causal model for fault diagnosis.

Prompt:
I am an electronic repairman sitting in front of a laborartoy power supply. It has two outputs 0-40V and 0-10A. The power supply is controlled through a circuit board with LM317 regulators using a standard layout. For amplifiers a parallel circuit of 4 2N3055 transistors are used. It seems I cannot adjust the maximum current output. What happened?

Prompt:
Using this scenario: "This scenario details a fully automated production line designed for the refinement of automotive glass using polyurethane. It includes not just individual machines but an entire production line. This production line is divided into three manufacturing cells (1: Primer Cell and Component Delivery, 2: Foaming Cell, and 3: Trimming Cell and Component Dispatch), which have been integrated into the production process and are described below. Cell 1: Primer Cell and Component Delivery The Primer Cell covers all necessary steps required before the actual foaming process. To ensure optimal adhesion between the glass pane and the polyurethane, a primer containing UV components is used. The primer acts as an adhesion promoter, while the UV components are later utilized for quality control through a camera system. The Primer Cell consists of the following modules: Glass rack for component delivery, centering station, primer mixer, primer station with camera system, robot including gripper system for handling components, and flash-off station. Initially, the glass pane is manually cleaned and pre-conditioned in the glass rack. The primer is prepared in the primer mixer and then filled into the primer station. The glass

panes enter the automatic process via the glass rack. Using the gripper system, the robot removes the glass pane, centers it at the centering station, and then transfers it to the primer station. Here, the primer is applied via an application head and immediately checked using the camera system. Following inspection, the primed glass pane is placed in the flash-off station, which serves both as a buffer storage and ensures the primer has sufficient time to flash off and react. Cell 2: Foaming Cell The developed Foaming Cell handles the actual foaming process. Here, the pretreated glass pane, necessary inserts, and polyurethane are combined. The mold carrier system, along with the foaming tool, is located within the foaming cabin, while the polyurethane machine is positioned outside the protective area. It connects via a piping system to the mixing head, which is attached to the foaming tool. The Foaming Cell consists of the following modules: Foaming cabin, mold carrier system, foaming tool, handling robot for tool cleaning, mold release agent application, insert placement, and polyurethane machine including barrel stations for polyol and isocyanate. After the flash-off period, the glass pane is removed from the flash-off station and placed into the foaming tool by the robotic gripper. The handling robot prepares the tool for the foaming process by cleaning, applying the mold release agent, and placing inserts. Simultaneously, the polyurethane machine conditions and tempers the individual polyol and isocyanate components. Once the foaming tool is closed and the required clamping force is achieved, the liquid polyurethane is injected into the cavity of the tool via the mixing head. After the reaction and curing time for the polyurethane, the robot removes the foamed glass pane from the foaming tool. Cell 3: Trimming Cell and Component Dispatch All subsequent processing steps following foaming are carried out in the developed Trimming Cell. Here, excess polyurethane is removed from the component. Subsequently, a quality inspection is performed, and components are sorted as either acceptable or defective. The Trimming Cell consists of the following modules: Robot including gripper system for component handling, trimming station with profile sensor, glass rack for component dispatch (acceptable components), and storage area for defective components. Initially, the robot removes the sprue from the component, previously separated by the sprue trimmer in the foaming tool. Then, the robot takes the foamed glass pane to the trimming station. There, excess polyurethane along the separation edge and in the so-called "flush area" is removed by trimming disks. After trimming, the component's quality is verified with a profile sensor. If needed, rework is performed. Finally, the component is either placed in the glass rack (acceptable components) or into the storage area (defective components) and removed from the automatic process. " Please create a causal graph of the system. Draw the diagram as a picture

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Imagine a full-adder Boolean circuit, please create a propositional logic strong-fault model. I.e. a model that does not only contain the normal working behaviour, but also contains provisions for the way components may fail. Create stuck-at-1 faults.

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Imagine a full-adder Boolean circuit, please create a propositional logic strong-fault model. I.e. a model that does not only contain the normal working behaviour, but also contains provisions for the way components may fail. Create stuck-at-1 faults. Imagine a fault in component X2. Draw the truth table.

Prompt:
Using structural analysis, please create the fault signature matrix, the physical equations, and resulting residuals from the following system: Some inflow is flowing through a paper towards a pump followed by a valve. The valve is then connected to a tank through a flow sensor. The output of the tank is threefold: two outputs go through one valve each into individual tanks. The third output bypasses those tanks. Both intermediate tanks, as well as the bypass, are connected to a summary tank. The output of the summary tank is adjusted by some valve and then flows out of the system. Assume that behind each valve is a flow-sensor connected in series. Use complete physical equations and not just balances.

Prompt: Explain what a Boolean logic strong-fault model is. What are its capabilities and weaknesses?

Prompt: Create residual values for a system that contains a tank that has an input valve and an output valve, both with attached flow sensors.

Prompt: Create residual values for a system that contains a tank that has an input valve and an output valve, both with attached flow sensors. What happens, if the output valve is stuck?

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