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## Fault tracing

⇒ Fault tracing refers to the process of identifying, analyzing, and rectifying potential faults or failures in machinery or systems within industrial settings.

⇒ Finding fault - analyzing - taking decision

### Importance:

i) Prevents Accidents:

⇒ Fault tracing helps in identifying potential weaknesses or malfunctions in machinery or systems that could lead to accidents.

ii) Maintain Operational Efficiency:

⇒ By identifying faults ~~early~~ in their early stage, can prevent downtime, maintain productivity & avoid breakdowns that improve operational efficiency.

iii) Compliance with regulations:

⇒ Fault tracing helps in meeting compliance with safety & regulatory standards set by authorities.

iv) Cost Reduction:

⇒ By identifying faults in their early stage, can prevent larger problems that might be expensive to fix later.

v) Optimize maintenance:

⇒ By identifying faults accurately helps in maintenance efforts towards critical areas.

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## Fault Tree analysis (FTA)

Analysis

- ⇒ Fault tree is a systematic approach which is used to evaluate potential failures within a system.
- ⇒ It involves creating a graphical diagram (the fault tree) that illustrates the various events that could lead to an undesired accident or failure.
- ⇒ In "FTA", the "top event" represents the failure or accident being analyzed.
- ⇒ The diagram is then broken down into this top event into contributing intermediate and basic events.
- ⇒ These intermediate events are higher-level failures, that when combined <sup>together</sup>, could lead to the top event.
- ⇒ Basic events are the most fundamental failures or issues within the system.
- ⇒ This method helps in analyzing how various events or failures in a system can lead to the top event, allowing proactive risk management & prevention strategies.

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## making a Decision Tree

i) Identify the Decision!

⇒ Determine the initial decision on problem you want to analyze.

ii) List Reasons!

⇒ Outline the potential options or reasons for the decision you want to make.

iii) List consequences!

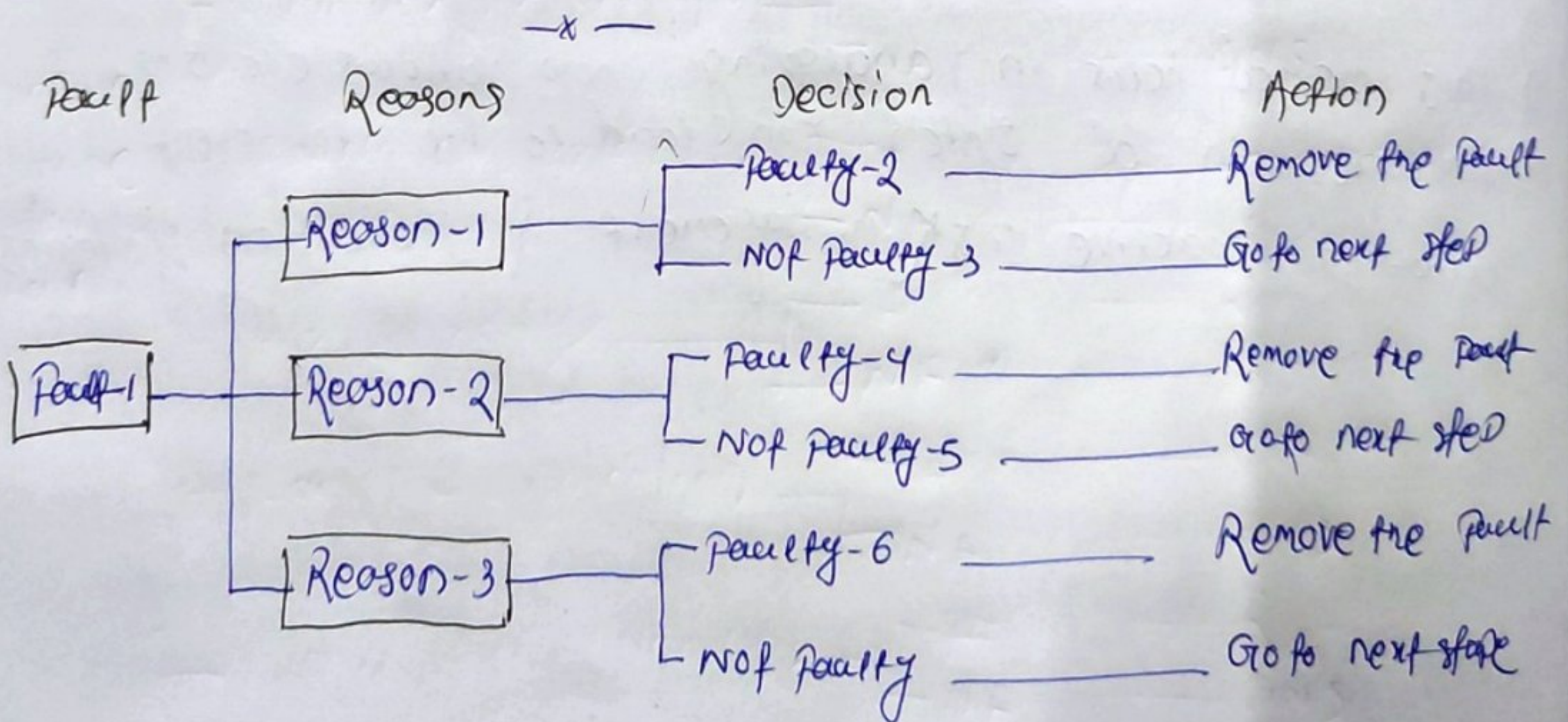
⇒ For each reason, outline the potential consequences, including positive outcomes & risks.

iv) Create branches!

⇒ Draw branches stemming from each decision node.

v) Evaluate & Action!

⇒ Evaluate the entire decision tree, considering all potential outcomes & then make informed actions.



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## Decision Tree for <sup>any</sup> one machine tool (Lathe chuck)

Fault	Reasons	Decision	Action
Lathe chuck stops rotating	- Check transmission belt (slipping)	- Faulty - 2	- Remove the fault
		- Not Faulty - 3	- Go to next step
	- Check mains switch fuse	- Faulty - 4	- Remove the fault
		- Not Faulty - 5	- Go to next step
	- Check power supply	- Faulty - 6	- Remove the fault
		- Not Faulty - 7	- Go to next step
	- Check electrical wiring & switches	- Faulty - 8	- Remove the fault
		- Not Faulty - 9	- Go to next step
	- Check pulley & joints	- Faulty - 10	- Remove the fault
		- Not Faulty - 11	- Go to next step
	- Check spindle bearing	- Faulty - 12	- Remove the fault
		- Not Faulty - 13	- Go to next step
	- Check spindle gear box	- Faulty - 14	- Remove the fault
		- Not Faulty - 15	- Go to next step

## ii) Decision Tree for Pump!

Fault	Reasons	Decision	Action
Pump fails to deliver water	- Priming required	- F (2)	- Remove the fault
		- NF (3)	- Go to next step
	- No water in the source	- F (4)	- Remove the fault
		- NF (5)	- Go to next step
	- Wrong impeller rotation (Direction)	- F (6)	- RTF
		- NF (7)	- GNS
	- Rotational speed is low	- F (8)	- RTF
		- NF (9)	- GNS
	- Clogged or section line of not valve	- F (10)	- RTF
		- NF (11)	- GNS
	- Section of delivery heads one more	- F (12)	- RTF
		- NF (13)	- GNS
	- Damaged or clogged of impeller	- F (14)	- RTF
		- NF (15)	- GNS

### iii) Decision Tree for Air Compressor!

Fault	Reasons	Decision	Action
Air-compressor Pressure is Low (1)	Transmission belt slippage	[ F (2) ——— RTF NF (3) ——— GNS	
	Air leakage	[ F (4) ——— RTF NF (5) ——— GNS	
	motor speed is low	[ F (6) ——— RTF NF (7) ——— GNS	
	Air filter clogged up	[ F (8) ——— RTF NF (9) ——— GNS	
	Damage pressure regulating Valve	[ F (10) ——— RTF NF (11) ——— GNS	
	Insufficient intercooling of air	[ F (12) ——— RTF NF (13) ——— GNS	
	Damaged pressure gauge	[ F (14) ——— RTF NF (15) ——— GNS	

### iv) Decision Tree for IC Engine!

Fault	Reasons	Decision	Action
Petrol Engine start to Fail (1)	worn out Piston Rings	[ F (1) ——— RTF NF (2) ——— GNS	
	Improper Air-fuel Ratio	[ F (3) ——— RTF NF (4) ——— GNS	
	Faulty carburetor	[ F (5) ——— RTF NF (6) ——— GNS	
	Poor Sparking	[ F (7) ——— RTF NF (8) ——— GNS	
	Lack of lubrication	[ F (9) ——— RTF NF (10) ——— GNS	
	worn out clutch plates	[ F (11) ——— RTF NF (12) ——— GNS	

v) Decision Tree for Boiler!

Fault	Reasons	Decisions	Actions
Boiler efficiency is low	Accumulation of slugs	F (2)	RTF
		NF (3)	GNS
	Incomplete fuel combustion	F (4)	RTF
		NF (5)	GNS
	water Leakage	F (6)	RTF
		NF (7)	GNS
	Incorrect air fuel ratio	F (8)	RTF
		NF (9)	GNS
	Faulty Insulation	F (10)	RTF
		NF (11)	GNS
Damage press Regulating valves	F (12)	RTF	
	NF (13)	GNS	

vi) Decision Tree for electric motor!

Fault	Reasons	Decision	Action
Electric motor becomes hot very quickly	Lack of lubrication	F (1)	RTF
		NF (2)	GNS
	Worn out bushings	F (3)	RTF
		NF (4)	GNS
	Broken bushings	F (5)	RTF
		NF (6)	GNS
	Faulty bearing	F (7)	RTF
		NF (8)	GNS
	right fitting of bearing	F (9)	RTF
		NF (10)	GNS
Insufficient cooling of bearing	F (11)	RTF	
	NF (12)	GNS	

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## - Types of Faults & their causes in the machine tool

### i) Mechanical Faults:

⇒ These faults are caused due to various factors like wear & tear, misalignment or fatigue.

### ii) Electrical Faults:

⇒ These faults are caused due to improper wiring, winding inadequate grounding etc.

### iii) Hydraulic Faults:

⇒ These faults are caused due to various factors like, oil leaks, pressure losses or valve malfunction.

### iv) Thermal Faults:

⇒ These faults are caused due to factors like, temperature variations, improper cooling, etc.

### v) Control-System Faults:

⇒ These faults are caused due to various factors like software glitches, programming error or sensor malfunction.

### vi) Vibration faults:

⇒ This fault is caused due to imbalances, worn components & poor installation.