

(software testing &)

# Risk Assessment

Lecture 1:

What is STAR, what is risk, FMEA

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February 5, 2025



# STAR

Two topics:

1. Risk assessment (week 6-9, minus break)
  - Identifying, analyzing, prioritizing risks to systems
  - ... using computer science!
2. Software testing (week 10-14)
  - Theory of *effective, model-based* testing
  - Practical testing tools

Connection: *make reliable systems*



# Assessment

## 1. Grade:

1. 50% exam (April 15, must be  $\geq 5.5$ )
2. 15% risk assessment group project (4-5 people, deadline March 3)
3. 25% software testing group project (4-5 people, deadline April 11)
4. 10% weekly homework



# STAR team

STAR team:

- Milan Lopuhaä-Zwakenberg
  - Assistant professor (mathematics of risk models)
  - Risk assessment lectures
  - [m.a.lopuhaa@utwente.nl](mailto:m.a.lopuhaa@utwente.nl)
- Petra van den Bos
  - Assistant professor (model-based testing)
  - Software testing lectures
  - [p.vandenbos@utwente.nl](mailto:p.vandenbos@utwente.nl)
- Reza Soltani
  - PhD student (safety & security risk models)
  - Tutorials, homework
  - [r.soltani@utwente.nl](mailto:r.soltani@utwente.nl)

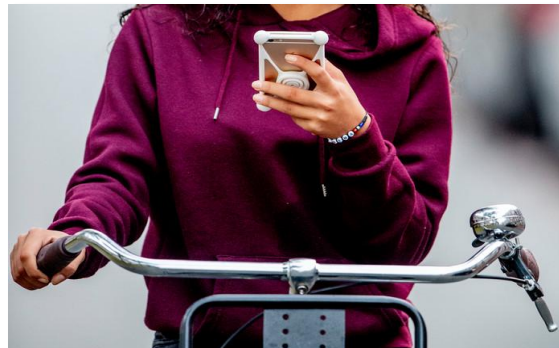


# Risk management

- No risk, no fun! (Carpe diem, YOLO...)



- Better safe than sorry



# Risk management

**Lock doors**



**Make back ups**



**Safety devices**



**Double check**



**Insurance**



**Face masks**



**Key:** Are we taking the right measures?

# Risk management

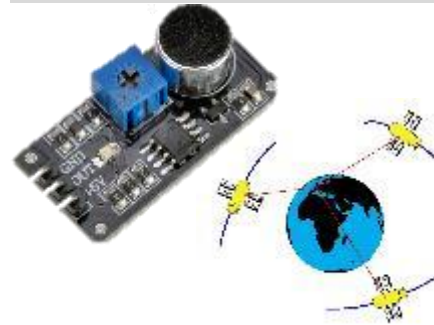
Self driving cars



Object detection



Sensors & GPS



35M LoC

```
WS.on("message", m => {
  let a = m.split(" ")
  switch(a[0]){
    case "connect":
      if(a[1]){
        if(clients.has(a[1])){
          ws.send("connected");
          ws.id = a[1];
        }else{
          ws.id = a[1]
          clients.set(a[1], {client: {position: {x: 0, y: 0, z: 0}}})
          ws.send("connected")
        }
      }
    }else{
      let id = Math.random().toString().slice(2, 10)
      ws.id = id;
      clients.set(id, {client: {position: {x: 0, y: 0, z: 0}}})
    }
  }
})
```

**Key:** How to minimize the risk and maximize the fun?

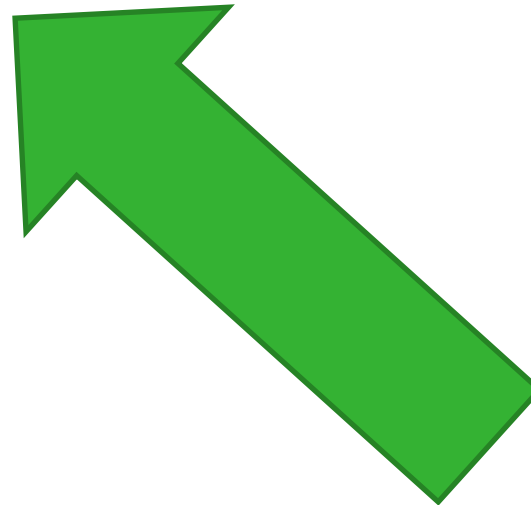
# Risk assessment topics

Risk assessment topics:

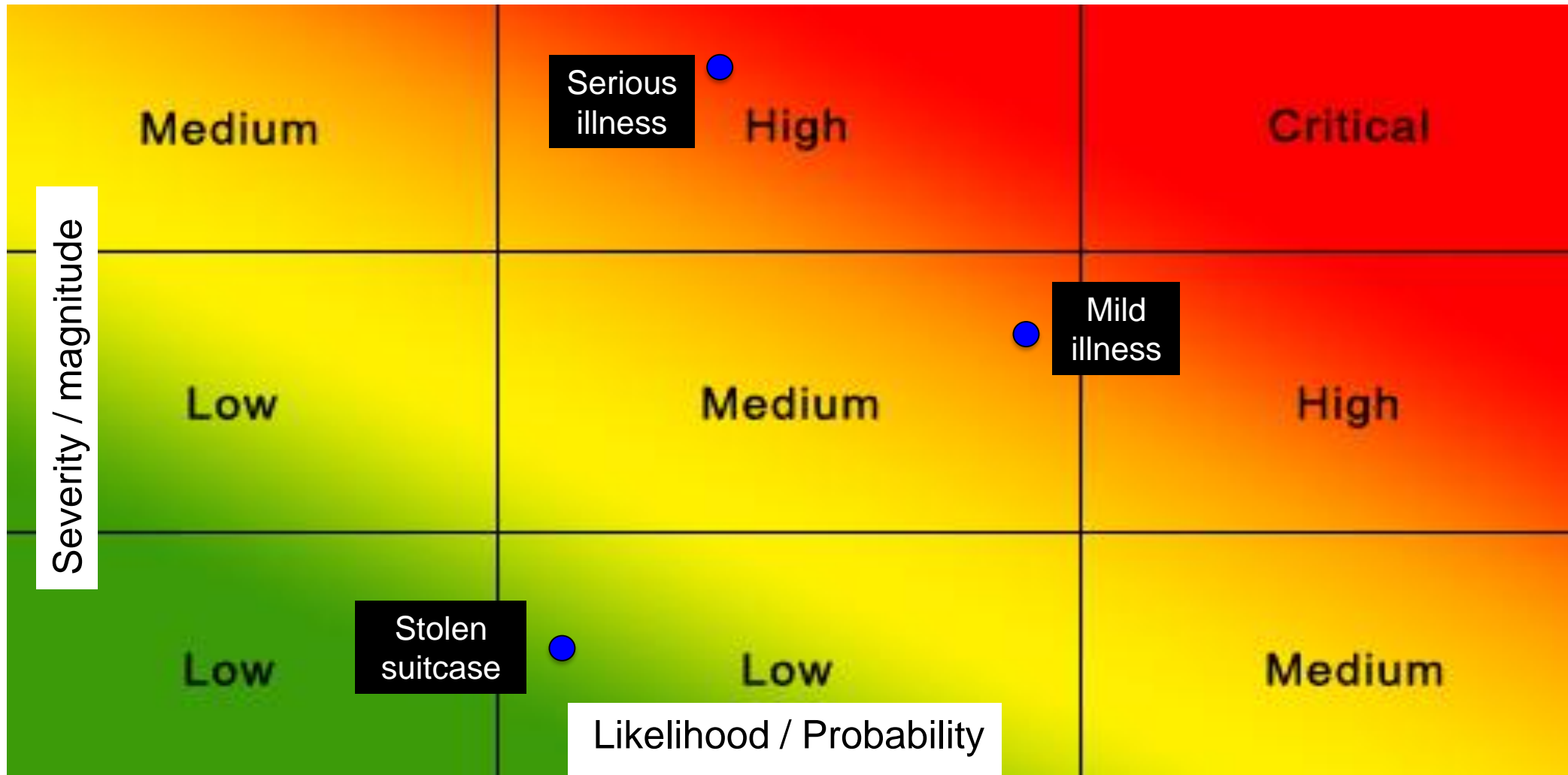
1. Today
  - a. What is risk?
  - b. Risk assessment matrix
  - c. FMEA (tekst-based risk model)
2. Feb 11
  - a. Fault trees (graph-based risk model)
  - b. FT analysis
3. Feb 25
  - a. Dynamic FTs
  - b. Dynamic FT analysis

# What is risk?

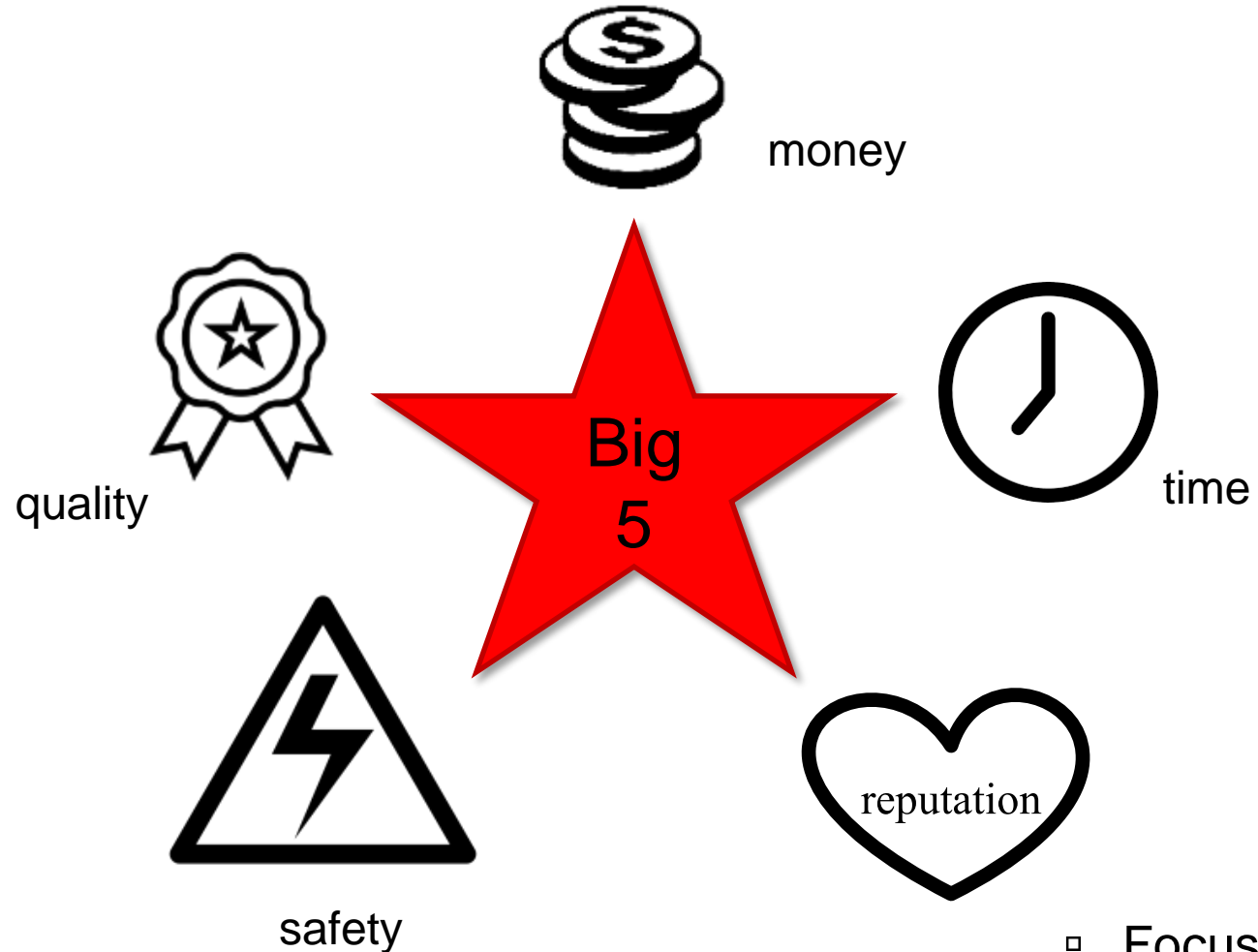
- **Haller (1975):** Risk is the possibility that positive expectations will not be realized.
  - **Wilson & Crouch (1982):** Risk is probability times impact.
  - **ISO (2002):** the combination of the probability of an event and its consequences
  - **ISO 31000 (2009):** the effect of uncertainty on objectives
    - Both positive and negative impact
    - Emphasis on goals.
      - Helps to focus
      - No goal = no risk
- Main ingredients:
    - Impact
    - Uncertainty
  - Applies to:
    - All domains
    - All systems
    - All phases



# Risk matrix



# Ingredient 1: Impact



- Focus on negative impact
- Contexts determines priorities

# Ingredient 1: Impact

## Qualitative impact

- Which impact?

Scale	Patient safety
1: Minor	Discomfort
2: Moderate	Light injury
3: Critical	Permanent injury
4: Catastrophic	Catastrophic: patient death

## Quantitative impact

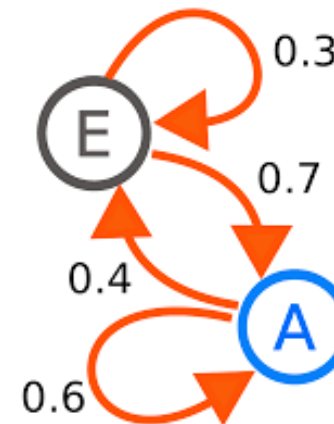
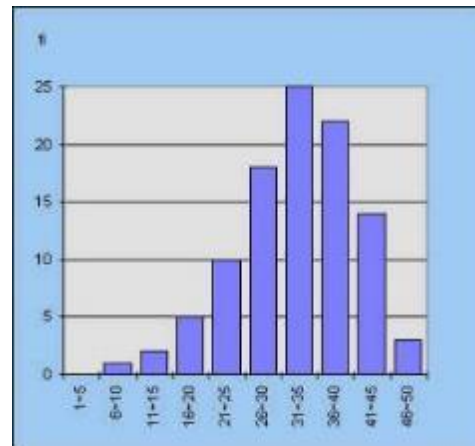
- How bad?
- Number/scale

## Ingredient 2: Uncertainty



# Ingredient 2: Uncertainty

Scale	Probability of Occurrence
1: Very unlikely	Never occurred in our field
2: Possibly	Has occurred once in 10 years
3: Once in a while	Every few years
4: Often	Several times a year
5: Regularly	Several times a month



# Ingredient 2: Uncertainty

Scale	Probability of Occurrence
1: Very unlikely	Never occurred in our field
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4: Often	Several times a year
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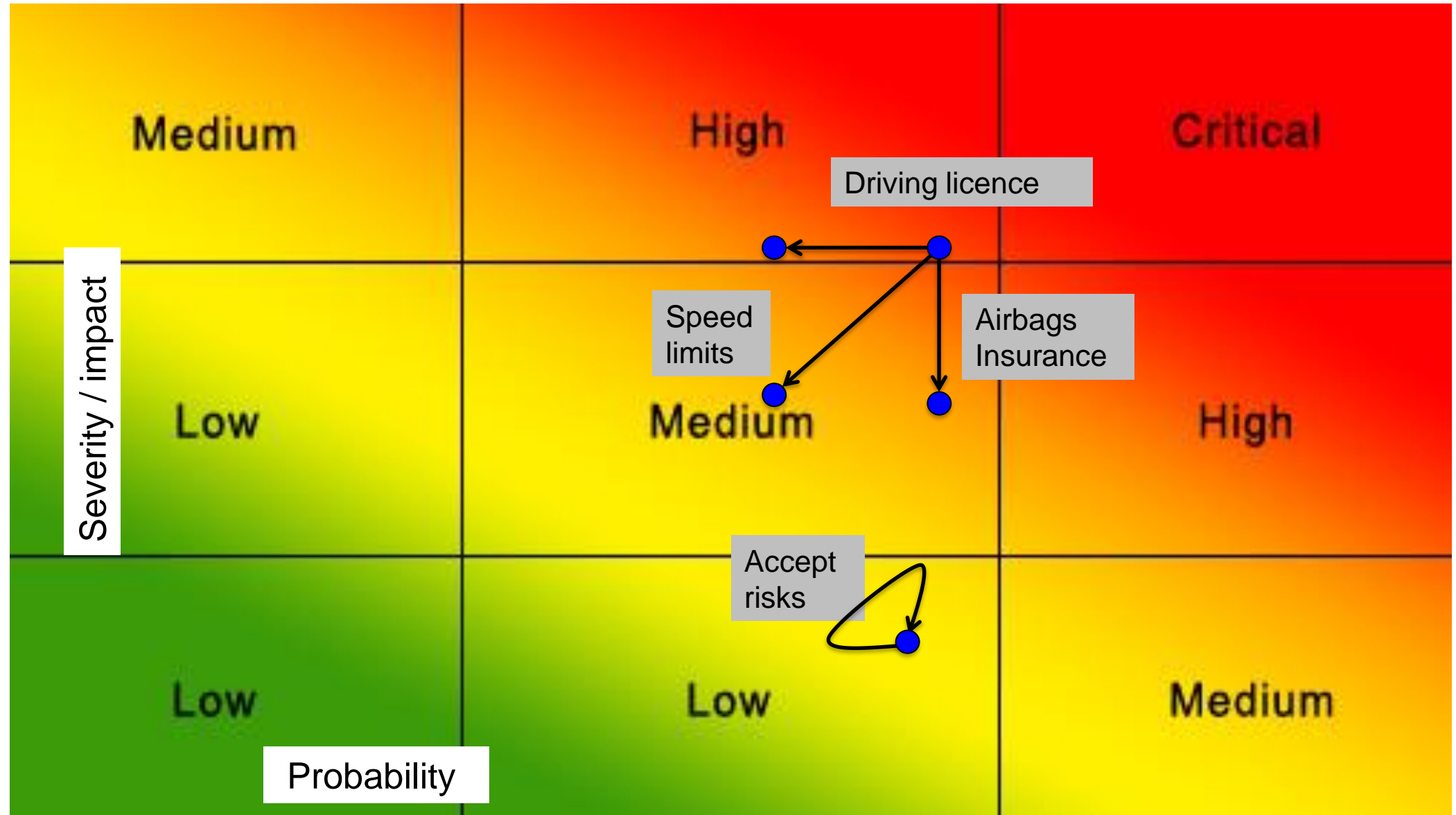
## A. Aleatoric/Stochastic/Objective:

- Effect of randomness
- Is the result of my coin flip heads or tails?

## B. Epistemic / Bayesian / Subjective

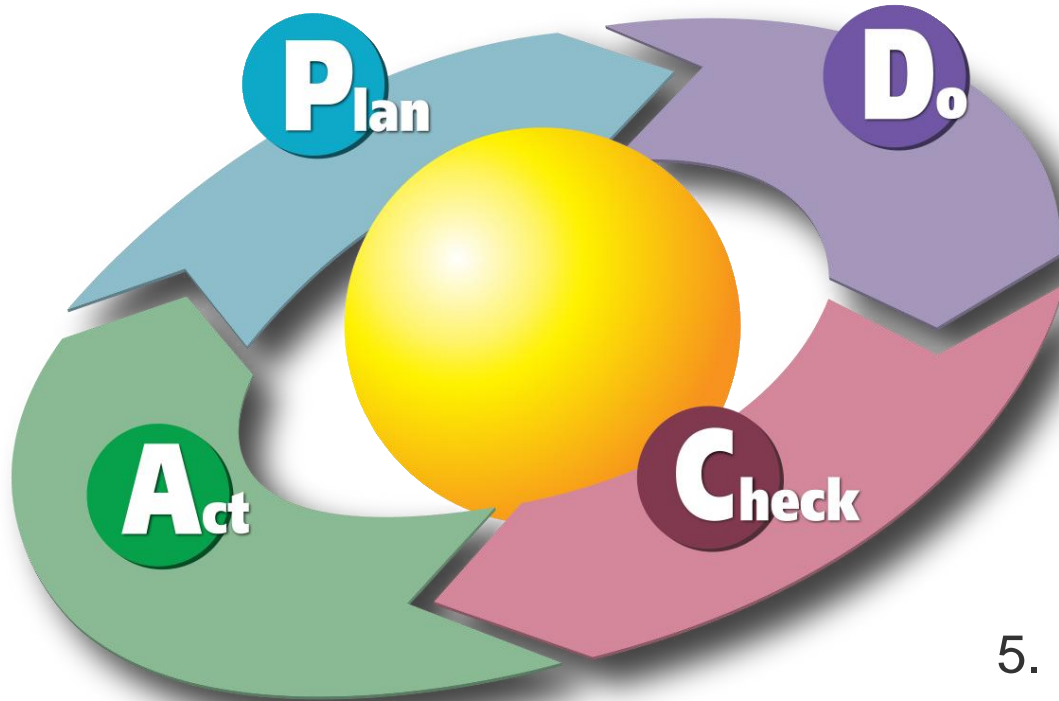
- Effect of ignorance
- Does Cree *mistikwân* mean *head* or *tail*?

# Risk matrix



# Deming cycle

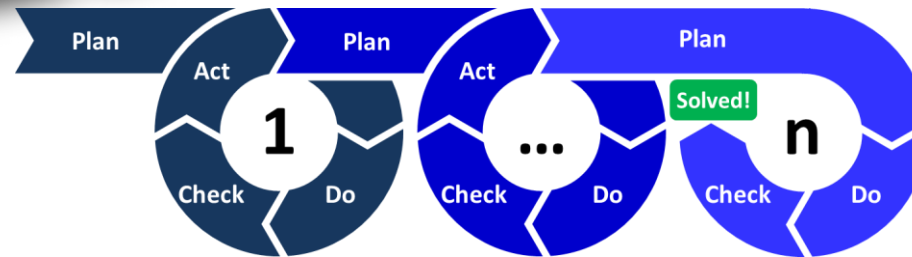
1. Determine goals



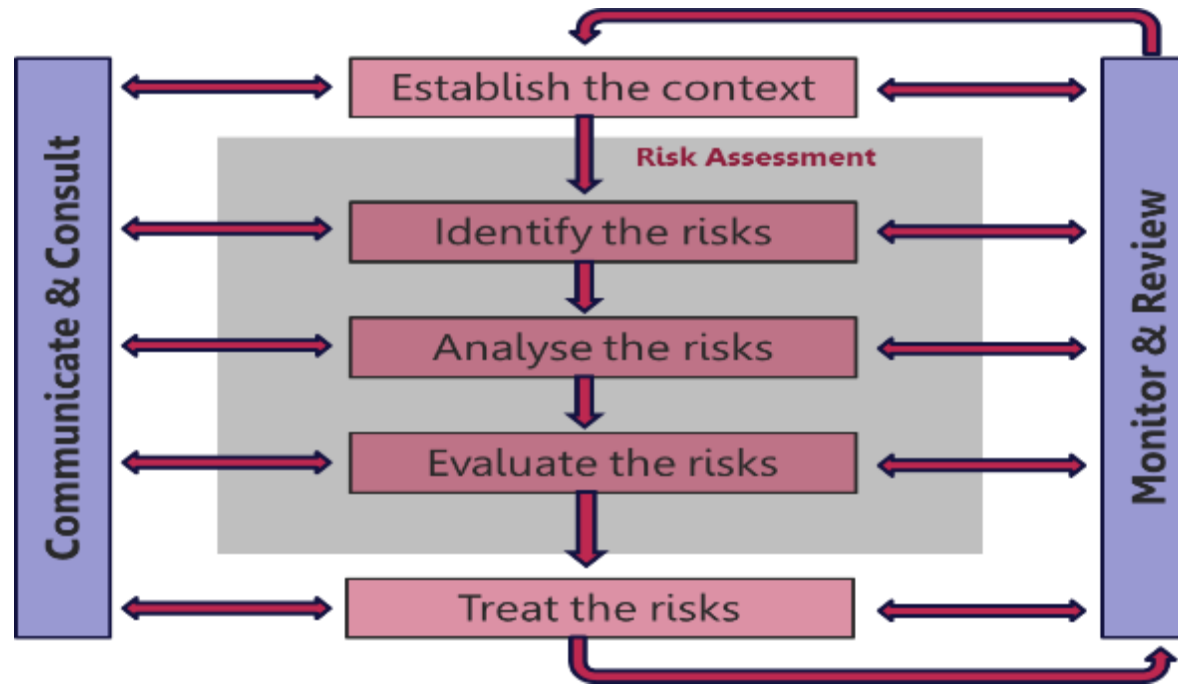
2. Identify risks  
3. Prioritize risks  
4. Design measures

6. Implement  
7. Document, communicate

5. Evaluate effectiveness

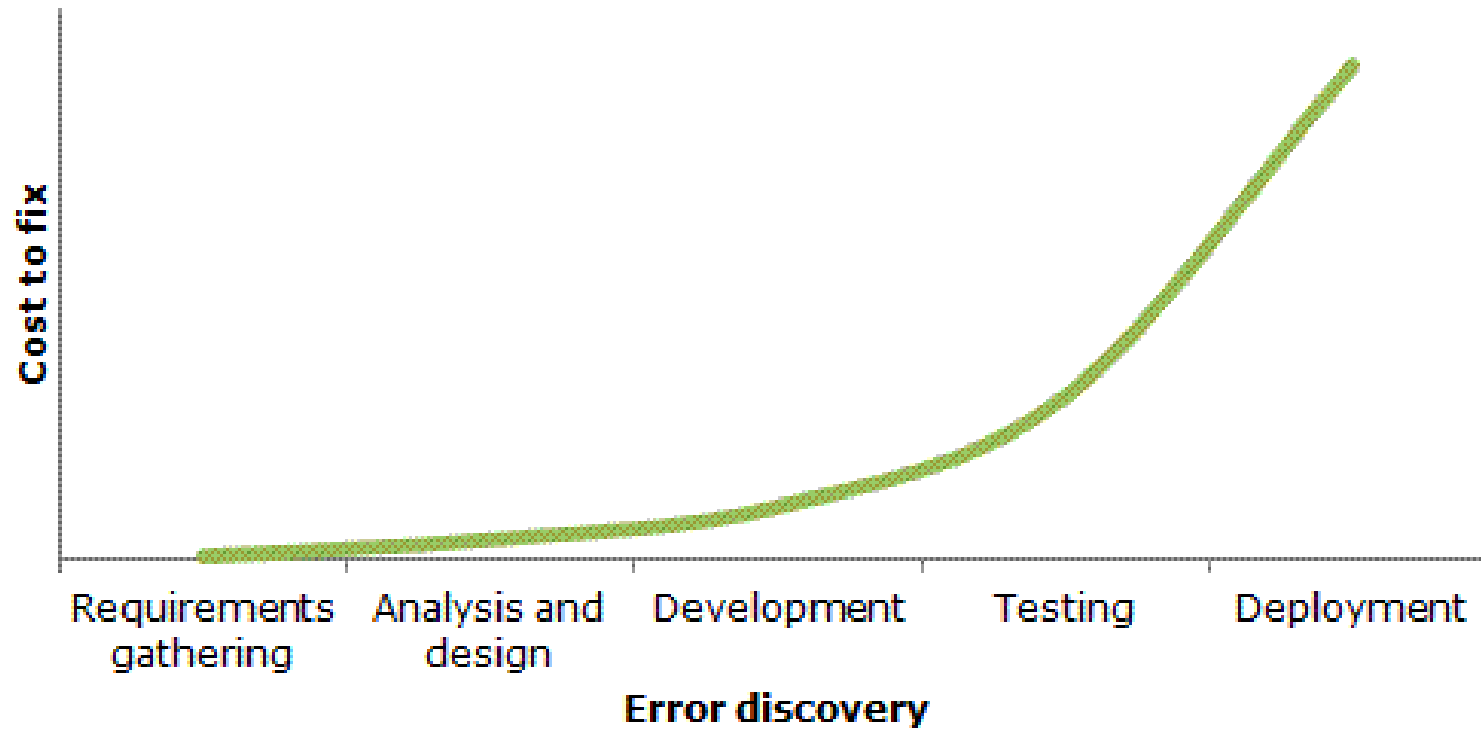


# Risk management standards

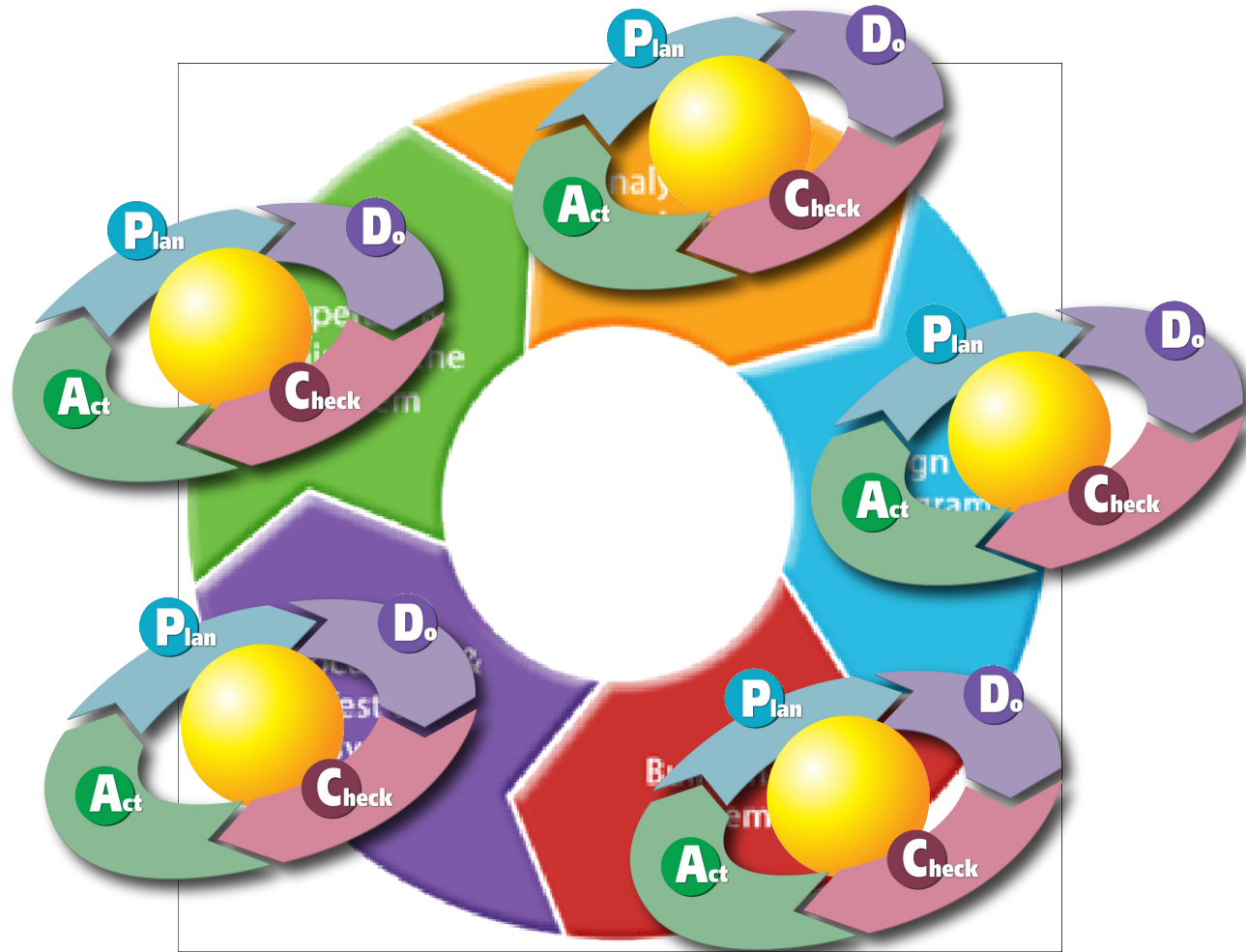


# When do you do risk assessment?

## Boehm's law



# When do you do risk assessment?



# 4 Risk strategies

- **Tolerate**
  - Accept the risks
  - Eg: going to the supermarket during Covid
- **Terminate**
  - Stop / do not start the activity
  - Eg: the lock down
- **Treat**
  - A: Reduce likelihood of occurrence: redundancy,
  - B: Reduce impact: airbags, rain coats, monitoring
- **Transfer**
  - Transfer the risk to someone else.
  - Eg: insurance, outsourcing, certification / supervision

# 4 Risk strategies

## **Categorize COVID measures**

- Wearing face masks
- Social distancing
- Financial support to pubs and restaurants
- Closing pubs and restaurants
- Vaccination
- Transfer of Covid patients between hospitals
- New treatment for COVID patients

A. tolerate

B. terminate

C. transfer

D. treat: reduce impact

E. treat: reduce probability

# Failure Mode & Effects Analysis (FMEA)

- Text/spreadsheet-based
- Design tool
  - Assessing risks for different ways (modes) a system can fail
  - Take appropriate measures
- Main benefit: Risks sorted by Risk Priority Number (RPN)
  - $RPN = \text{probability} \times \text{severity} \times \text{detection}$

Process Step	Potential Failure Mode	Potential Failure Effect	SEV <sup>1</sup>	Potential Causes	OCC <sup>2</sup>	Current Process Controls	DET <sup>3</sup>	RPN <sup>4</sup>	Action Recommended
What is the step?	In what ways can the step go wrong?	What is the impact on the customer if the failure mode is not prevented or corrected?	How severe is the effect on the customer?	What causes the step to go wrong (i.e., how could the failure mode occur)?	How frequently is the cause likely to occur?	What are the existing controls that either prevent the failure mode from occurring or detect it should it occur?	How probable is detection of the failure mode or its cause?	Risk priority number calculated as SEV x OCC x DET	What are the actions for reducing the occurrence of the cause or for improving its detection? Provide actions on all high RPNs and on severity ratings of 9 or 10.
ATM Pin Authentication	Unauthorized access	<ul style="list-style-type: none"> <li>Unauthorized cash withdrawal</li> <li>Very dissatisfied customer</li> </ul>	8	Lost or stolen ATM card	3	Block ATM card after three failed authentication attempts	3	72	
	Authentication failure	Annoyed customer	3	Network failure	5	Install load balancer to distribute work-load across network links	5	75	
Dispense Cash	Cash not disbursed	Dissatisfied customer	7	ATM out of cash	7	Internal alert of low cash in ATM	4	196	Increase minimum cash threshold limit of heavily used ATMs to prevent out-of-cash instances
	Account debited but no cash disbursed	Very dissatisfied customer	8	<ul style="list-style-type: none"> <li>Transaction failure</li> <li>Network issue</li> </ul>	3	Install load balancer to distribute work-load across network links	4	96	
	Extra cash dispensed	Bank loses money	8	<ul style="list-style-type: none"> <li>Bills stuck to each other</li> <li>Bills stacked incorrectly</li> </ul>	2	Verification while loading cash in ATM	3	48	

# FMEA step-by-step

1. Determine design tree
2. Determine function tree
3. Determine failures for each function
4. Quantify
5. Find measures
6. **Reassess**

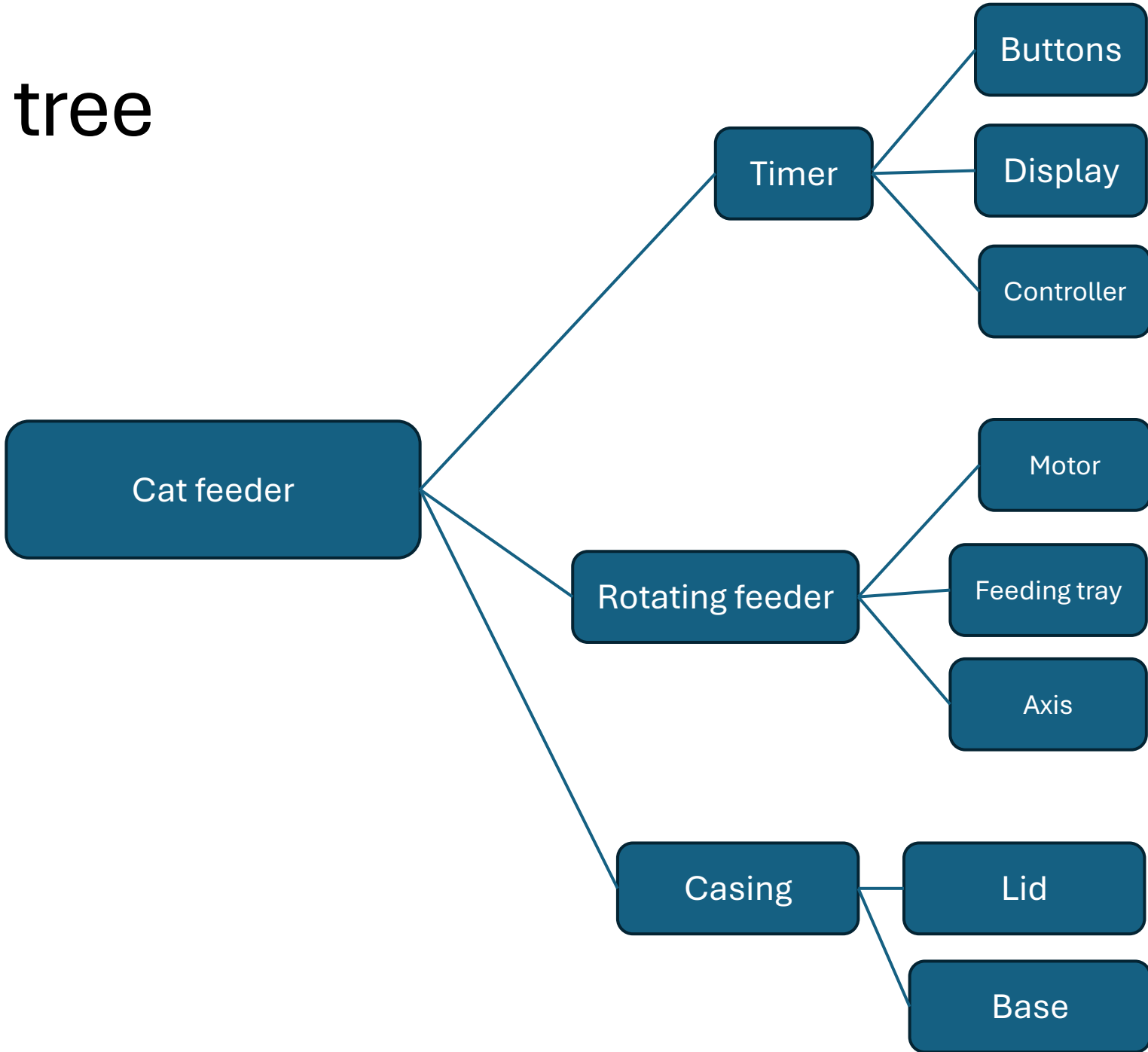
# FMEA step 1: design tree



My cat Mandy



Automatic cat feeder



# FMEA step 2: function trees

## Functions

1. Feed Mandy on time
2. Withhold food otherwise
3. User-programmable

# FMEA step 2: function trees

	Feed Mandy	Withhold food	User-programmable
Timer			
Rotating feeder			
Casing			

# FMEA step 2: function trees

	Feed Mandy	Withhold food	User-programmable
Timer	Send rotate commands at right time		
Rotating feeder			
Casing			

# FMEA step 2: function trees

	Feed Mandy	Withhold food	User-programmable
Timer	Send rotate commands at right time		
Rotating feeder	Present filled tray		
Casing			

# FMEA step 2: function trees

	Feed Mandy	Withhold food	User-programmable
Timer	Send rotate commands at right time		
Rotating feeder	Present filled tray		
Casing	Large opening		

# FMEA step 2: function trees

	Feed Mandy	Withhold food	User-programmable
Timer	Send rotate commands at right time	Don't send rotate commands at wrong time	
Rotating feeder	Present filled tray		
Casing	Large opening		

# FMEA step 2: function trees

	Feed Mandy	Withhold food	User-programmable
Timer	Send rotate commands at right time	Don't send rotate commands at wrong time	
Rotating feeder	Present filled tray	Non-moveable by cats; only one tray visible	
Casing	Large opening		

# FMEA step 2: function trees

	Feed Mandy	Withhold food	User-programmable
Timer	Send rotate commands at right time	Don't send rotate commands at wrong time	
Rotating feeder	Present filled tray	Non-moveable by cats; only one tray visible	
Casing	Large opening	Only one tray visible; solid material	

# FMEA step 2: function trees

	<b>Feed Mandy</b>	<b>Withhold food</b>	<b>User-programmable</b>
Timer	Send rotate commands at right time	Don't send rotate commands at wrong time	User can enter and verify commands
Rotating feeder	Present filled tray	Non-moveable by cats; only one tray visible	
Casing	Large opening	Only one tray visible; solid material	

# FMEA step 2: function trees

	<b>Feed Mandy</b>	<b>Withhold food</b>	<b>User-programmable</b>
Timer	Send rotate commands at right time	Don't send rotate commands at wrong time	User can enter and verify commands
Rotating feeder	Present filled tray	Non-moveable by cats; only one tray visible	
Casing	Large opening	Only one tray visible; solid material	User can open casing

# FMEA step 2: function trees

	Feed Mandy	Withhold food	User-programmable
Timer	Send rotate commands at right time	Don't send rotate commands at wrong time	User can enter and verify commands
Buttons			
Display			
Controller			
Rotating feeder	Present filled tray	Non-moveable by cats; only one tray visible	
Motor			
Rotating tray			
Axis			
Casing	Large opening	Only one tray visible; solid material	User can open casing
Lid			
Base			

# FMEA step 2: function trees

	Feed Mandy	Withhold food	User-programmable
Timer	Send rotate commands at right time	Don't send rotate commands at wrong time	User can enter and verify commands
Buttons			
Display			
Controller	Send rotate commands at right time		
Rotating feeder	Present filled tray	Non-moveable by cats; only one tray visible	
Motor			
Rotating tray			
Axis			
Casing	Large opening	Only one tray visible; solid material	User can open casing
Lid			
Base			

# FMEA step 2: function trees

	Feed Mandy	Withhold food	User-programmable
Timer	Send rotate commands at right time	Don't send rotate commands at wrong time	User can enter and verify commands
Buttons			
Display			
Controller	Send rotate commands at right time		
Rotating feeder	Present filled tray	Non-moveable by cats; only one tray visible	
Motor	Rotate right amount		
Rotating tray			
Axis			
Casing	Large opening	Only one tray visible; solid material	User can open casing
Lid			
Base			

# FMEA step 2: function trees

	Feed Mandy	Withhold food	User-programmable
Timer	Send rotate commands at right time	Don't send rotate commands at wrong time	User can enter and verify commands
Buttons			
Display			
Controller	Send rotate commands at right time		
Rotating feeder	Present filled tray	Non-moveable by cats; only one tray visible	
Motor	Rotate right amount		
Rotating tray	Large enough		
Axis			
Casing	Large opening	Only one tray visible; solid material	User can open casing
Lid			
Base			

# FMEA step 2: function trees

	Feed Mandy	Withhold food	User-programmable
Timer	Send rotate commands at right time	Don't send rotate commands at wrong time	User can enter and verify commands
Buttons			
Display			
Controller	Send rotate commands at right time		
Rotating feeder	Present filled tray	Non-moveable by cats; only one tray visible	
Motor	Rotate right amount		
Rotating tray	Large enough		
Axis	Sturdy enough		
Casing	Large opening	Only one tray visible; solid material	User can open casing
Lid			
Base			

# FMEA step 2: function trees

	Feed Mandy	Withhold food	User-programmable
Timer	Send rotate commands at right time	Don't send rotate commands at wrong time	User can enter and verify commands
Buttons			
Display			
Controller	Send rotate commands at right time		
Rotating feeder	Present filled tray	Non-moveable by cats; only one tray visible	
Motor	Rotate right amount		
Rotating tray	Large enough		
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Lid	Large opening		
Base			

# FMEA step 2: function trees

	Feed Mandy	Withhold food	User-programmable
Timer	Send rotate commands at right time	Don't send rotate commands at wrong time	User can enter and verify commands
Buttons			
Display			
Controller	Send rotate commands at right time	Don't send rotate commands at wrong time	
Rotating feeder	Present filled tray	Non-moveable by cats; only one tray visible	
Motor	Rotate right amount		
Rotating tray	Large enough		
Axis	Sturdy enough		
Casing	Large opening	Only one tray visible; solid material	User can open casing
Lid	Large opening		
Base			

# FMEA step 2: function trees

	Feed Mandy	Withhold food	User-programmable
Timer	Send rotate commands at right time	Don't send rotate commands at wrong time	User can enter and verify commands
Buttons			
Display			
Controller	Send rotate commands at right time	Don't send rotate commands at wrong time	
Rotating feeder	Present filled tray	Non-moveable by cats; only one tray visible	
Motor	Rotate right amount	Non-movable by cats	
Rotating tray	Large enough		
Axis	Sturdy enough		
Casing	Large opening	Only one tray visible; solid material	User can open casing
Lid	Large opening		
Base			

# FMEA step 2: function trees

	Feed Mandy	Withhold food	User-programmable
Timer	Send rotate commands at right time	Don't send rotate commands at wrong time	User can enter and verify commands
Buttons			
Display			
Controller	Send rotate commands at right time	Don't send rotate commands at wrong time	
Rotating feeder	Present filled tray	Non-moveable by cats; only one tray visible	
Motor	Rotate right amount	Non-movable by cats	
Rotating tray	Large enough	Tray same size as opening	
Axis	Sturdy enough		
Casing	Large opening	Only one tray visible; solid material	User can open casing
Lid	Large opening		
Base			

# FMEA step 2: function trees

	Feed Mandy	Withhold food	User-programmable
Timer	Send rotate commands at right time	Don't send rotate commands at wrong time	User can enter and verify commands
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Display			
Controller	Send rotate commands at right time	Don't send rotate commands at wrong time	
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Axis	Sturdy enough		
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Base			

# FMEA step 2: function trees

	Feed Mandy	Withhold food	User-programmable
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Display			
Controller	Send rotate commands at right time	Don't send rotate commands at wrong time	
Rotating feeder	Present filled tray	Non-moveable by cats; only one tray visible	
Motor	Rotate right amount	Non-movable by cats	
Rotating tray	Large enough	Tray same size as opening	
Axis	Sturdy enough		
Casing	Large opening	Only one tray visible; solid material	User can open casing
Lid	Large opening	Tray same size as opening; solid material	
Base		Solid material	

# FMEA step 2: function trees

	Feed Mandy	Withhold food	User-programmable
Timer	Send rotate commands at right time	Don't send rotate commands at wrong time	User can enter and verify commands
Buttons			Functioning buttons
Display			
Controller	Send rotate commands at right time	Don't send rotate commands at wrong time	
Rotating feeder	Present filled tray	Non-moveable by cats; only one tray visible	
Motor	Rotate right amount	Non-movable by cats	
Rotating tray	Large enough	Tray same size as opening	
Axis	Sturdy enough		
Casing	Large opening	Only one tray visible; solid material	User can open casing
Lid	Large opening	Tray same size as opening; solid material	
Base		Solid material	

# FMEA step 2: function trees

	Feed Mandy	Withhold food	User-programmable
Timer	Send rotate commands at right time	Don't send rotate commands at wrong time	User can enter and verify commands
Buttons			Functioning buttons
Display			Functioning display
Controller	Send rotate commands at right time	Don't send rotate commands at wrong time	
Rotating feeder	Present filled tray	Non-moveable by cats; only one tray visible	
Motor	Rotate right amount	Non-movable by cats	
Rotating tray	Large enough	Tray same size as opening	
Axis	Sturdy enough		
Casing	Large opening	Only one tray visible; solid material	User can open casing
Lid	Large opening	Tray same size as opening; solid material	
Base		Solid material	

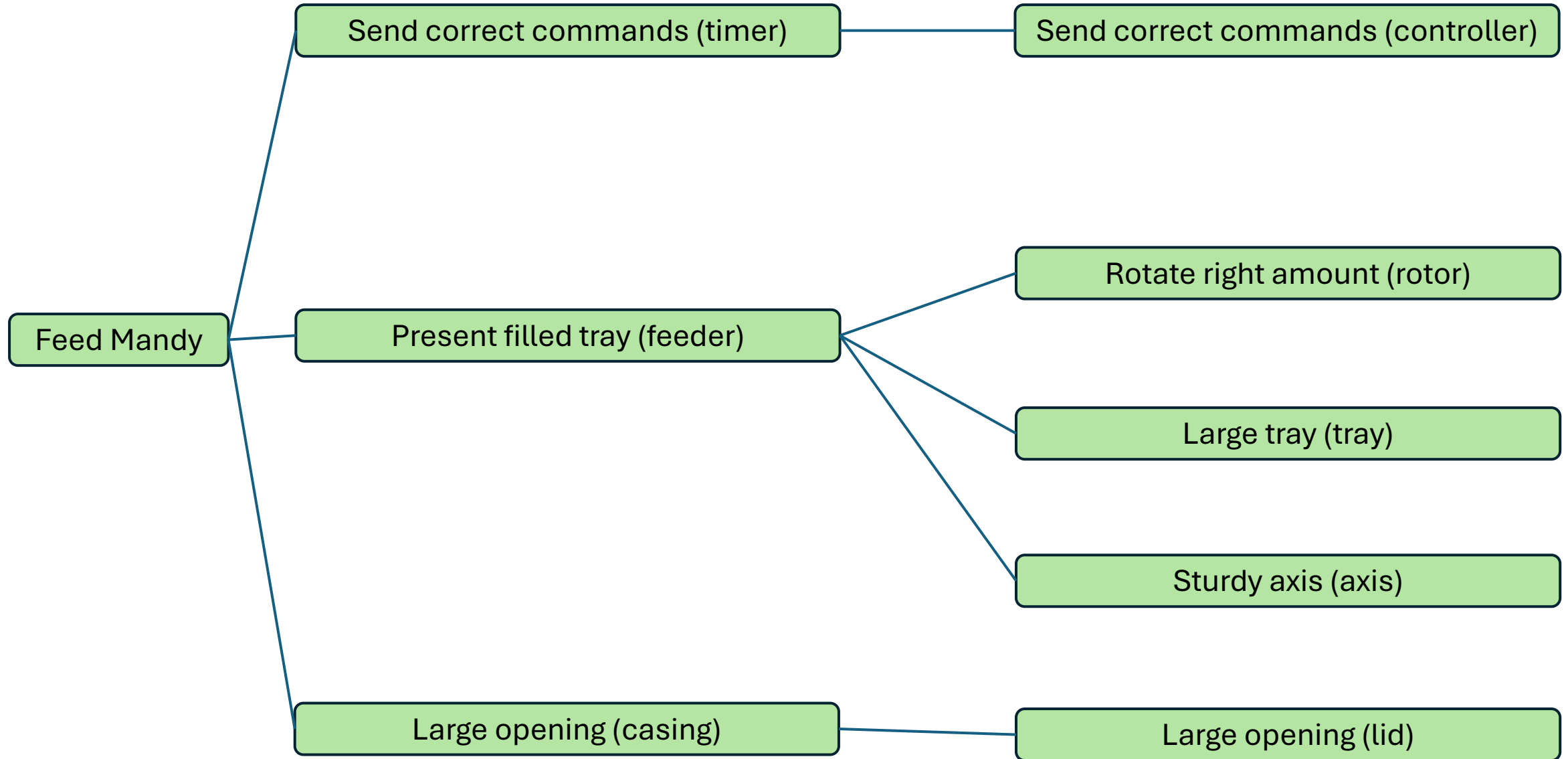
# FMEA step 2: function trees

	Feed Mandy	Withhold food	User-programmable
Timer	Send rotate commands at right time	Don't send rotate commands at wrong time	User can enter and verify commands
Buttons			Functioning buttons
Display			Functioning display
Controller	Send rotate commands at right time	Don't send rotate commands at wrong time	Correct logic; functioning timer
Rotating feeder	Present filled tray	Non-moveable by cats; only one tray visible	
Motor	Rotate right amount	Non-movable by cats	
Rotating tray	Large enough	Tray same size as opening	
Axis	Sturdy enough		
Casing	Large opening	Only one tray visible; solid material	User can open casing
Lid	Large opening	Tray same size as opening; solid material	
Base		Solid material	

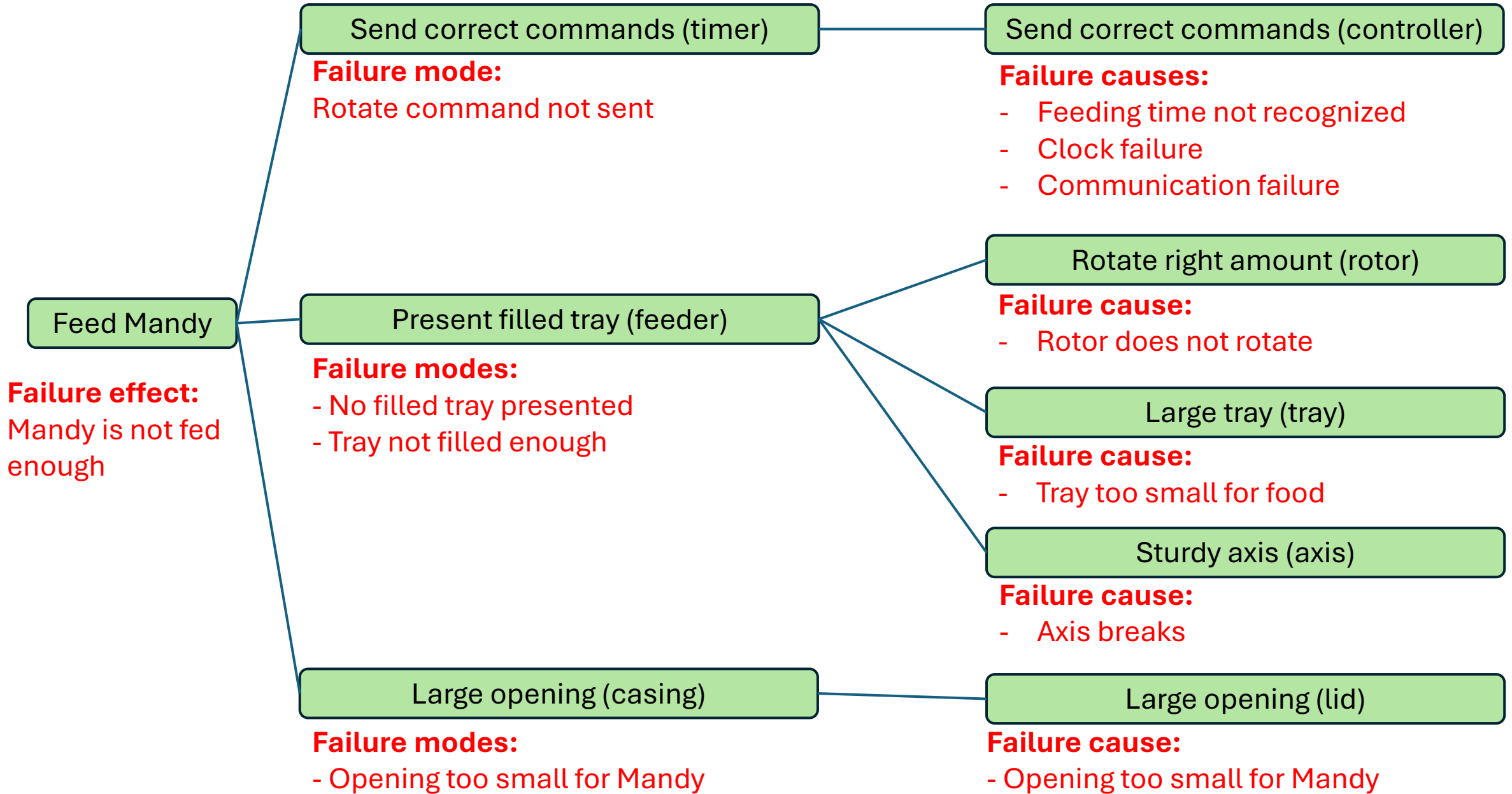
# FMEA step 2: function trees

	Feed Mandy	Withhold food	User-programmable
Timer	Send rotate commands at right time	Don't send rotate commands at wrong time	User can enter and verify commands
Buttons			Functioning buttons
Display			Functioning display
Controller	Send rotate commands at right time	Don't send rotate commands at wrong time	Correct logic; functioning timer
Rotating feeder	Present filled tray	Non-moveable by cats; only one tray visible	
Motor	Rotate right amount	Non-movable by cats	
Rotating tray	Large enough	Tray same size as opening	
Axis	Sturdy enough		
Casing	Large opening	Only one tray visible; solid material	User can open casing
Lid	Large opening	Tray same size as opening; solid material	Removable lid
Base		Solid material	Removable lid

# FMEA step 2: function trees



# FMEA step 3: determine failures



# FMEA step 3: determine failures

1. Failure effect:
  1. Design-level
  2. Effect on user (or his cat)
2. Failure mode:
  1. System level
  2. Failures
3. Failure cause
  1. Component level
  2. Contributes to failure

# FMEA form (Step 4: Quantify)

Failure effect				
Mandy is not fed enough				

# FMEA form (Step 4: Quantify)

Failure effect				
Mandy is not fed enough				
Mandy fed too early				
...				

# FMEA form (Step 4: Quantify)

Failure effect	Failure mode			
Mandy is not fed enough				
Mandy fed too early				
...				

# FMEA form (Step 4: Quantify)

Failure effect	Failure mode				
Mandy is not fed enough	Rotate command not sent No filled tray presented Tray not filled enough Opening too small				
Mandy fed too early					
...					

# FMEA form (Step 4: Quantify)

Failure effect	Failure mode				
Mandy is not fed enough	Rotate command not sent No filled tray presented Tray not filled enough Opening too small				
Mandy fed too early	... ... ...				
...					

# FMEA form (Step 4: Quantify)

Failure effect	Failure mode	Severity		
Mandy is not fed enough	Rotate command not sent No filled tray presented Tray not filled enough Opening too small	1-10 scale!		
Mandy fed too early	... ... ...			
...				

# FMEA form (Step 4: Quantify)

Failure effect	Failure mode	Severity			
Mandy is not fed enough	Rotate command not sent	10			
	No filled tray presented	10			
	Tray not filled enough	6			
	Opening too small	4			
Mandy fed too early	...				
	...				
	...				
...					

# FMEA form (Step 4: Quantify)

Failure effect	Failure mode	Severity	Potential causes		
Mandy is not fed enough	Rotate command not sent	10			
	No filled tray presented	10			
	Tray not filled enough	6			
	Opening too small	4			
Mandy fed too early	...				
	...				
	...				
...					

# FMEA form (Step 4: Quantify)

Failure effect	Failure mode	Severity	Potential causes		
Mandy is not fed enough	Rotate command not sent	10	<ul style="list-style-type: none"> <li>- Feeding time not recognized</li> <li>- Clock failure</li> <li>- Comm. Failure</li> </ul>		
	No filled tray presented	10	<ul style="list-style-type: none"> <li>- Rotor does not rotate</li> <li>- Axis breaks</li> </ul>		
	Tray not filled enough	6	Tray too small		
	Opening too small	4	Opening too small		
Mandy fed too early	...				
...					

# FMEA form (Step 4: Quantify)

Failure effect	Failure mode	Severity	Potential causes	Probability	Detection	
Mandy is not fed enough	Rotate command not sent	10	<ul style="list-style-type: none"> <li>- Feeding time not recognized</li> <li>- Clock failure</li> <li>- Comm. Failure</li> </ul>	<div style="border: 1px solid black; padding: 5px; display: inline-block;">1-10 scale!</div>		
	No filled tray presented	10	<ul style="list-style-type: none"> <li>- Rotor does not rotate</li> <li>- Axis breaks</li> </ul>			
	Tray not filled enough	6	Tray too small			
	Opening too small	4	Opening too small			
Mandy fed too early	...					
...						

# FMEA form (Step 4: Quantify)

Failure effect	Failure mode	Severity	Potential causes	Probability	Detection	
Mandy is not fed enough	Rotate command not sent	10	<ul style="list-style-type: none"> <li>- Feeding time not recognized</li> <li>- Clock failure</li> <li>- Comm. Failure</li> </ul>	6		
	No filled tray presented	10	<ul style="list-style-type: none"> <li>- Rotor does not rotate</li> <li>- Axis breaks</li> </ul>	3		
	Tray not filled enough	6	Tray too small	2		
	Opening too small	4	Opening too small	2		
Mandy fed too early	...					
...						

# FMEA form (Step 4: Quantify)

Failure effect	Failure mode	Severity	Potential causes	Probability	Detection	
Mandy is not fed enough	Rotate command not sent	10	<ul style="list-style-type: none"> <li>- Feeding time not recognized</li> <li>- Clock failure</li> <li>- Comm. Failure</li> </ul>	6	9	
	No filled tray presented	10	<ul style="list-style-type: none"> <li>- Rotor does not rotate</li> <li>- Axis breaks</li> </ul>	3	9	
	Tray not filled enough	6	Tray too small	2	2	
	Opening too small	4	Opening too small	2	1	
Mandy fed too early	...					
...						

# FMEA form (Step 4: Quantify)

S x P x D

Failure effect	Failure mode	Severity	Potential causes	Probability	Detection	Risk Priority Number
Mandy is not fed enough	Rotate command not sent	10	<ul style="list-style-type: none"> <li>- Feeding time not recognized</li> <li>- Clock failure</li> <li>- Comm. Failure</li> </ul>	6	9	
	No filled tray presented	10	<ul style="list-style-type: none"> <li>- Rotor does not rotate</li> <li>- Axis breaks</li> </ul>	3	9	
	Tray not filled enough	6	Tray too small	2	2	
	Opening too small	4	Opening too small	2	1	
Mandy fed too early	...					
...						

# FMEA form (Step 4: Quantify)

Failure effect	Failure mode	Severity	Potential causes	Probability	Detection	Risk Priority Number
Mandy is not fed enough	Rotate command not sent	10	<ul style="list-style-type: none"> <li>- Feeding time not recognized</li> <li>- Clock failure</li> <li>- Comm. Failure</li> </ul>	6	9	540
	No filled tray presented	10	<ul style="list-style-type: none"> <li>- Rotor does not rotate</li> <li>- Axis breaks</li> </ul>	3	9	270
	Tray not filled enough	6	Tray too small	2	2	24
	Opening too small	4	Opening too small	2	1	8
Mandy fed too early	...					
...						

# FMEA steps 5-6

5. Find measures (if risks are not acceptable)

**6. Reassess**

## Thoughts on FMEA

- Systematic approach helps
- Wonky mathematics, but can be appropriate

# Conclusion

## **Today:**

1. What is STAR?
2. What is RISK?
3. What is FMEA?

## **Tomorrow: first tutorial**

- Work on first homework (deadline Wednesday Feb 12)

**Form teams for RA group project (next slide)**

# Risk assessment group project

- Groups of 4-5 people
- Deadline: Mar 3
- Goal: do 3 types of risk assessment on a system of your choice
  - Risk matrix
  - FMEA
  - Fault tree
- Discuss advantages/disadvantages of approaches