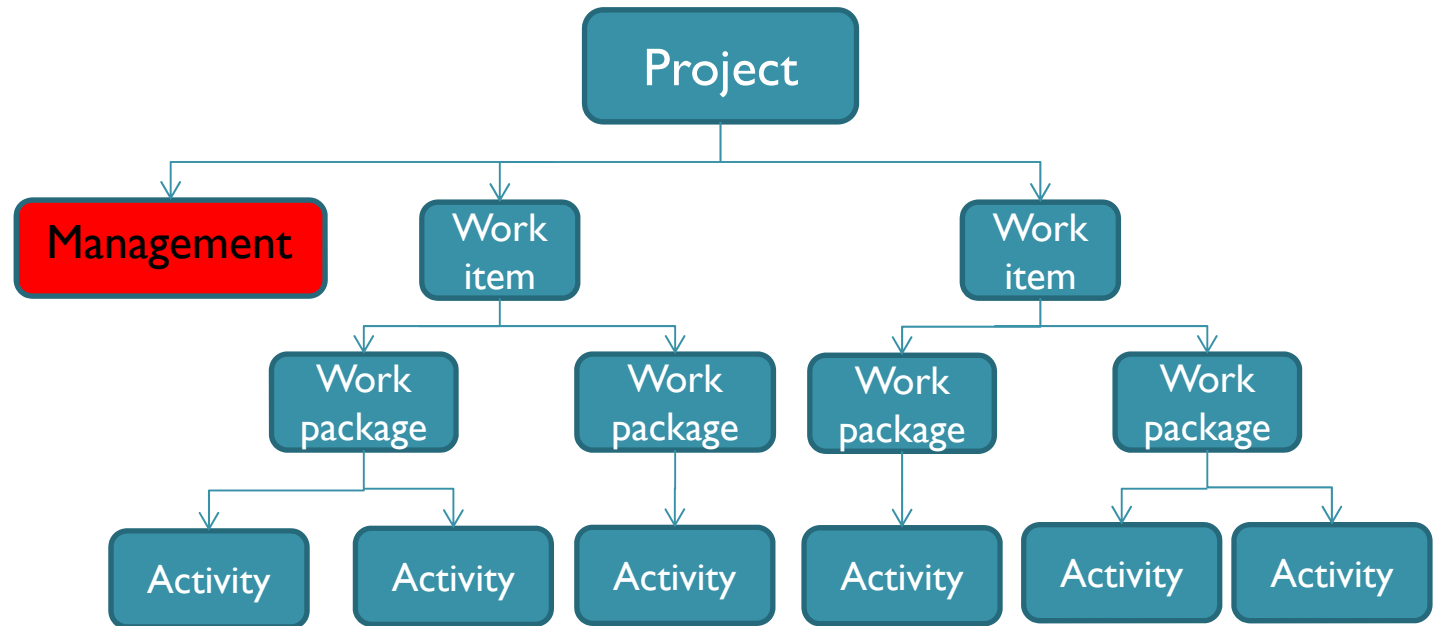
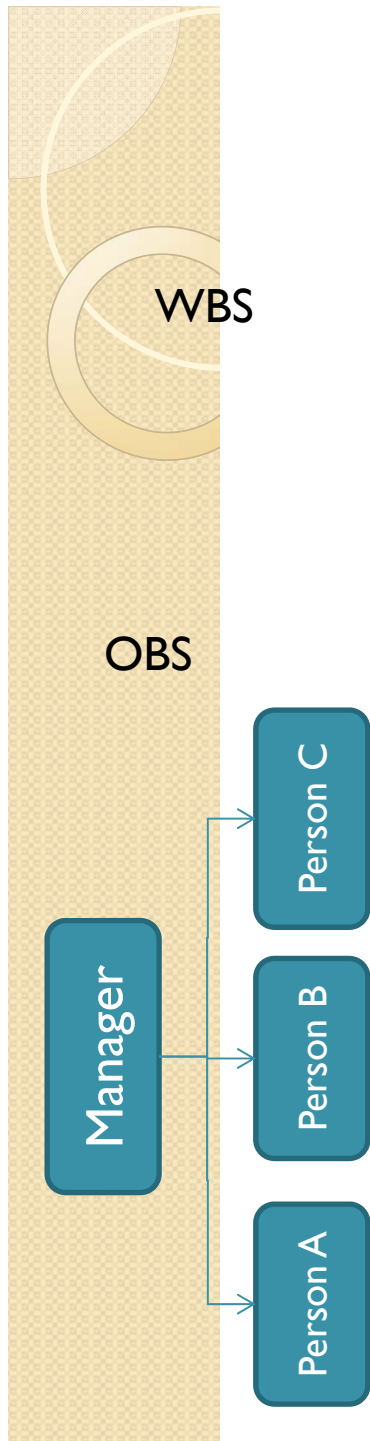




Risk assessment

CpE 190 and EEE 193A

Week 6



X		X			
	X	X		X	
			X	X	X

RAM: responsibility assignment matrix



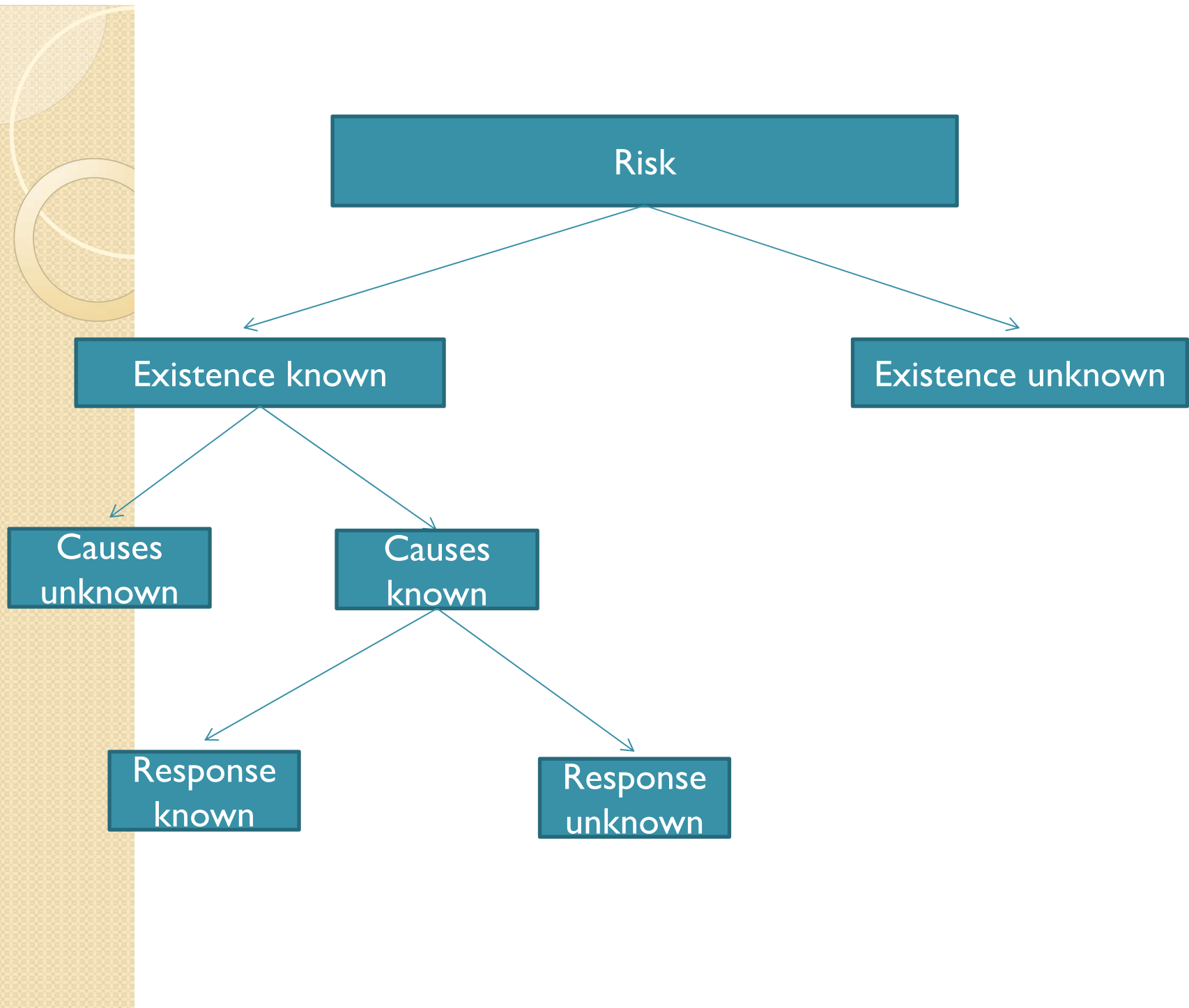
Risk management

At every step in the development, unpredictable outcomes can be encountered that pose risk to the project or certain parts of the project. The goal of the engineer is to steer a course that reduces risks while achieving maximum results. No project is risk free.

Risk management: defined in ISO 31000 as *the effect of uncertainty on objectives, whether positive or negative*.

In this definition, uncertainties include events (which may or may not happen) and uncertainties caused by a lack of information or ambiguity. This definition also includes both negative and positive impacts on objectives.

ISO: International Organization for Standardization





Sources of Failure

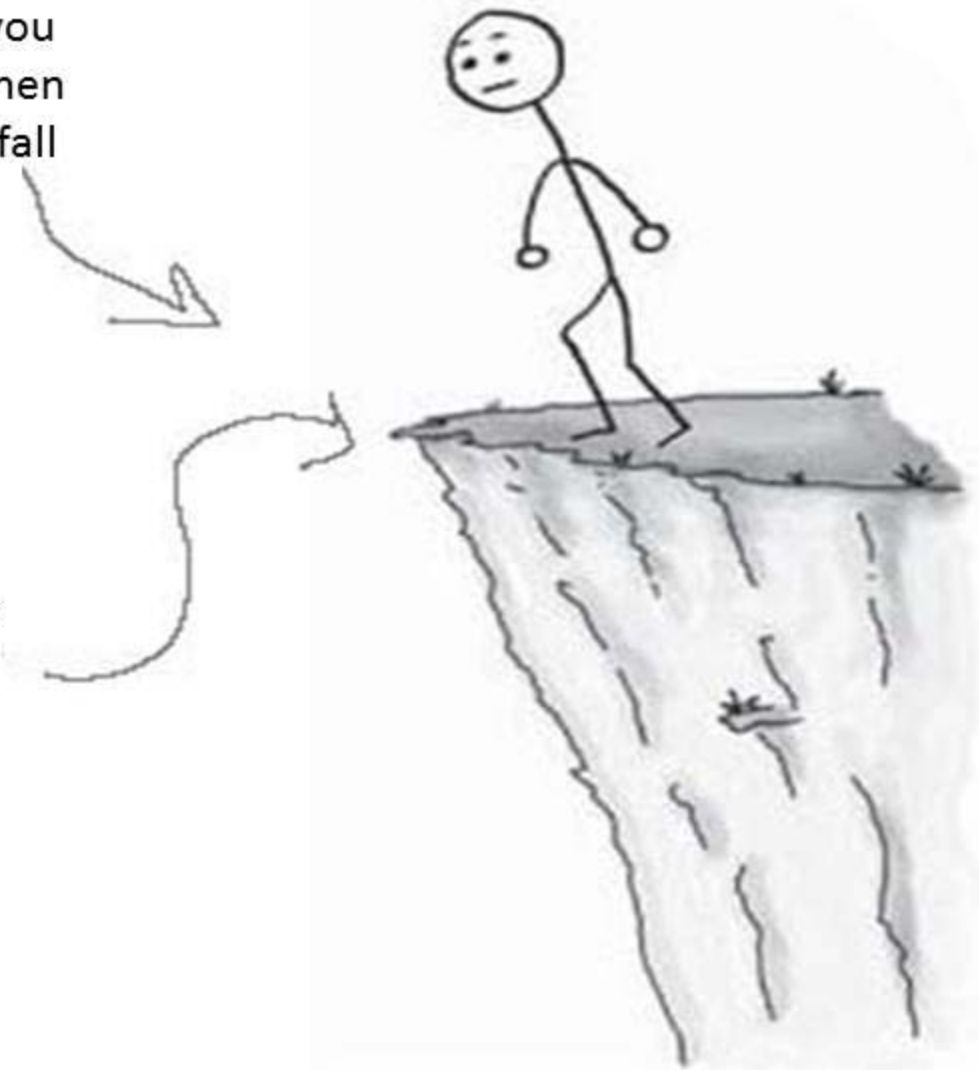
- Hardware Failure
- Software Failure
- Human Failure
- Organizational Failure
- External Failure

“successful projects are not selected but shaped with risk resolution in mind.”

W ← Wind → E

If your project requires that you stand on the edge of a cliff, then there is a risk that you could fall

What are the uncertainties that may contribute to increasing the risk?





Risk management is a multidisciplinary topic:

- Project management: industrial and system engineering, software engineering, etc.
- Financial institutions
- Insurance companies
- Risk management for megaprojects



Characteristics of Successful Risk Management Approaches

- Risk management should begin at the earliest stage
- Risk management is a continuous process
- Risks increase with complexity: For complex systems, we need more systematic and formal methods and tools to manage risks.
- Risks increase with the lack of information, ambiguity.



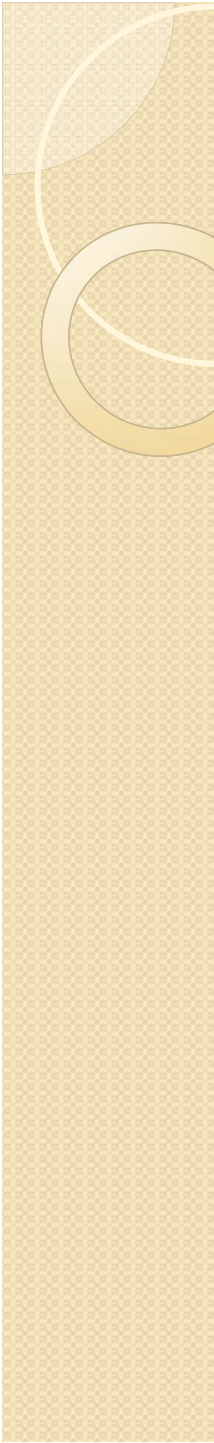
What are the most important attributes of risk ?

- 1% chance of losing \$10,000
- 50% chance of losing \$200



What are the most important attributes of risk?

Risk likelihood: probability of failure.



What are the most important attributes of risk?

- Risk likelihood: probability of failure
- Risk criticality: impact of failure



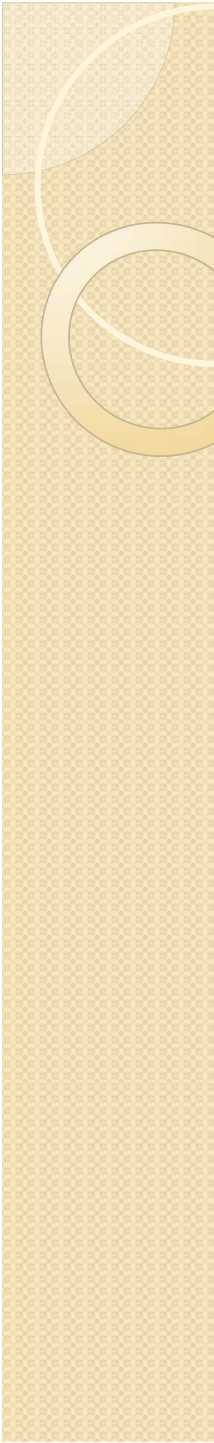
We associate two basic attributes with risk:

- Probability, P: stands for the likelihood that an event will occur.
- Impact, I: stands for the impact of the event.

Risk (R) can be defined mathematically as a function of two variables:

$$R (P , I)$$

What is simplest way to model and compute the risk?



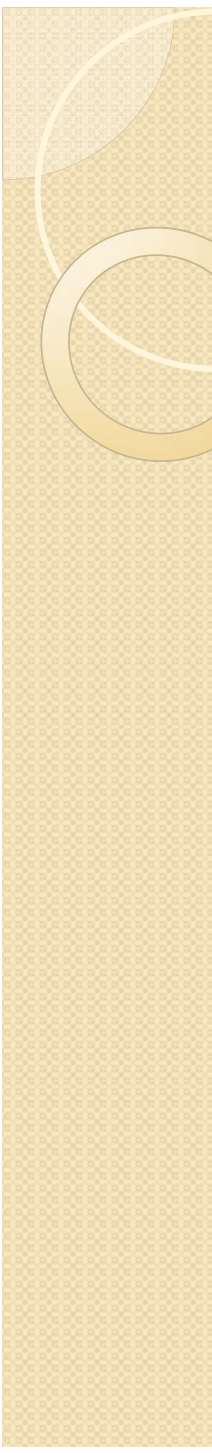
Risk=Impact x Likelihood

$$R = I \times P$$

P=0, there is no risk.

P=1, R=I (risk=impact)

$$0 < P < 1$$



Recent risk management literature has broadened the definition of risk: defined in ISO 31000 as the effect of uncertainty on objectives, whether **positive** or negative.

- Negative events offer risk.
- Positive events offer opportunity.
- Negative effect: $I > 0; R > 0$



Risk identification

Risk identification is the very first activity in the risk management process. The goal here is to identify risks before they become serious problems

Question: what could go wrong?

Procedure:

- List the WBS elements
- Determine what could go wrong for each element.
- What are the typical risks in a small engineering project?



Risk analysis:

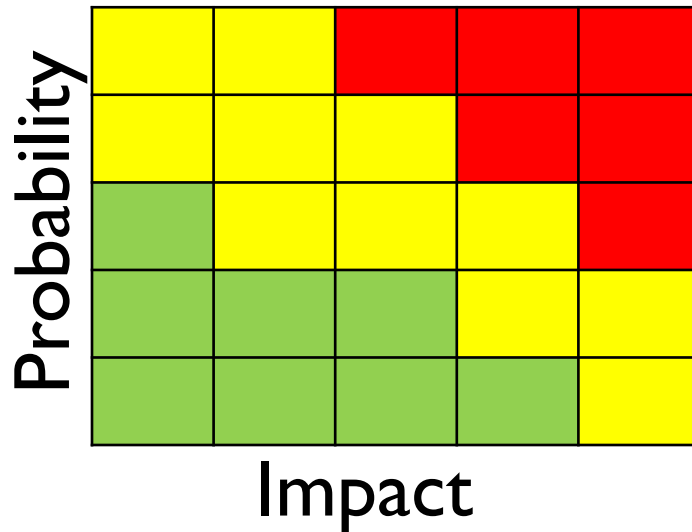
Gather information about the risk. We want to answer the question:

How bad is the risk?

Procedure

- Identify the likelihood of failure in each element
- Identify the possible impact
- Use the risk reporting matrix to identify the risk level.

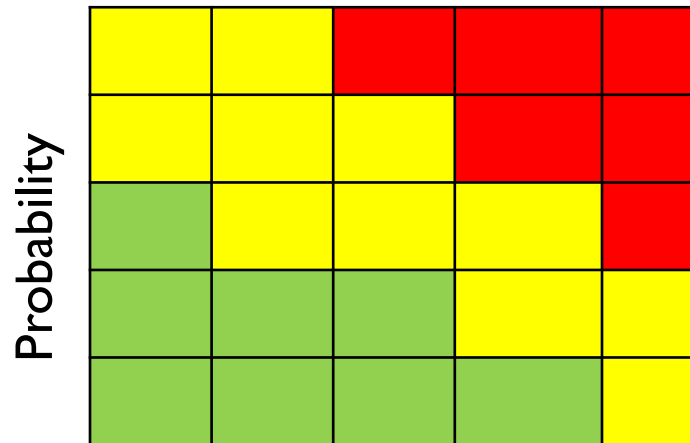
Risk matrix



Level	impact
1	Minimum or no impact
2	Impact can be tolerated
3	Limited impact
4	May jeopardize project
5	Will jeopardize project

Level	likelihood	probability
1	Not likely	0.1
2	Low likelihood	0.3
3	Likely	0.5
4	Highly likely	0.7
5	Near certainty	0.9

Risk matrix



Impact

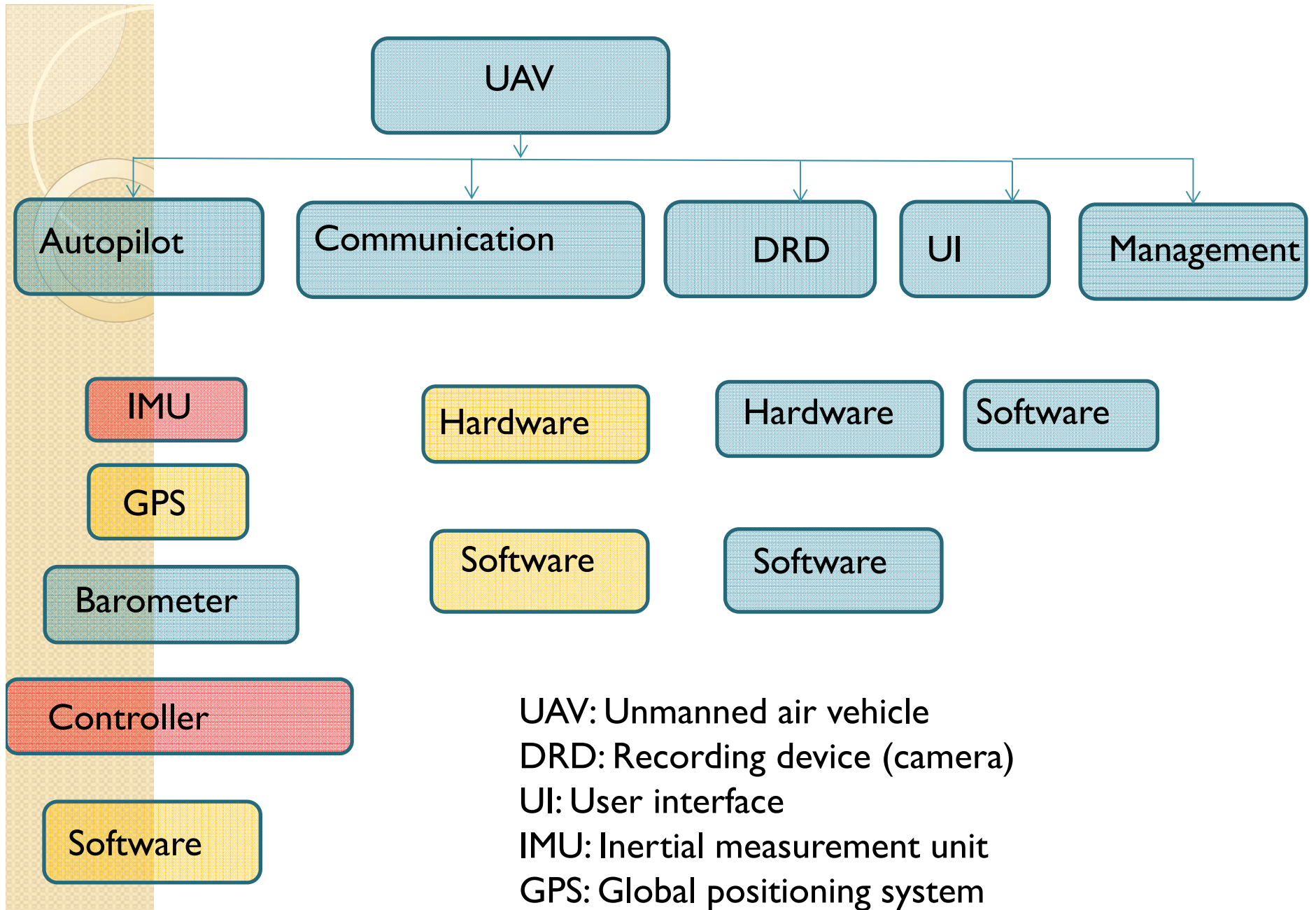
You have \$5,000 in your account

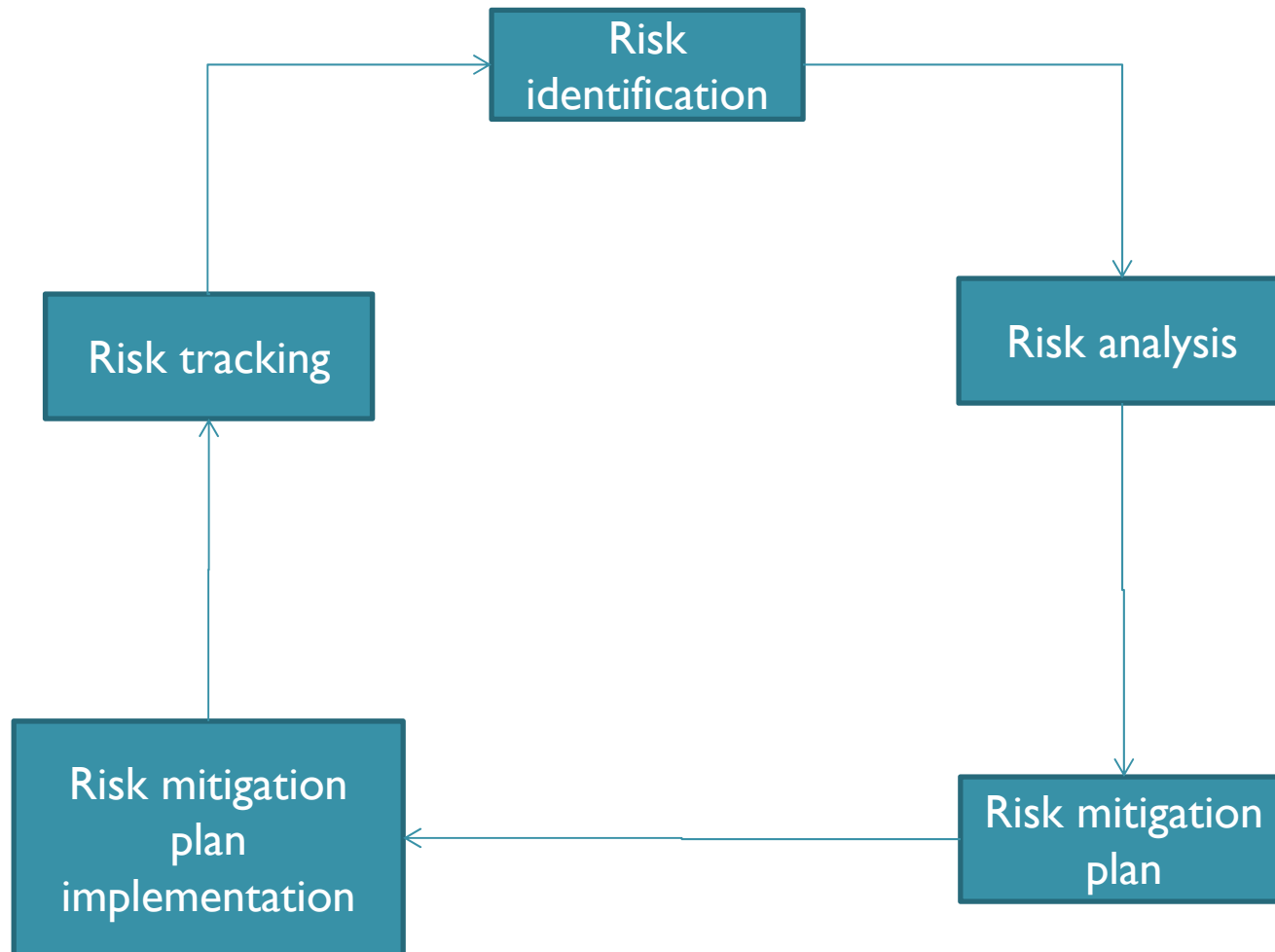
- 1% chance of losing \$5,000
- 50% chance of losing \$500
- 80% chance of losing \$2,000

Calculate the risk for each case.

Impact	Level
\$5,000	5
\$500	1
\$2,000	2

Case	Risk
1% chance of losing \$5,000	0.05
50% chance of losing \$500	0.5
80% chance of losing	1.6





DoD risk assessment paradigm
Risk assessment is a continuous (iterative) process.



Risk Mitigation Planning

Risk information is translated to decisions and actions. The intent of risk mitigation planning is to answer the question: **What is the approach for addressing the impact?**

Risk mitigation includes the specifics of **what** should be done, **when** it should be done, and **who** is responsible.

One or more of these mitigation options may apply:

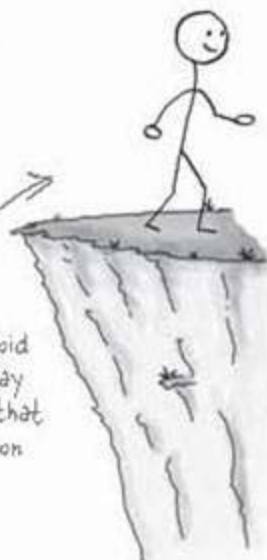
1. Avoiding risk by eliminating the root cause and/or the consequence,
2. Controlling the cause or consequence,
3. Transferring the risk, and/or
4. Assuming the level of risk and continue on the current program plan.

1

Avoid

The best thing that you can do with a risk is avoid it—if you can prevent it from happening, it definitely won't hurt your project.

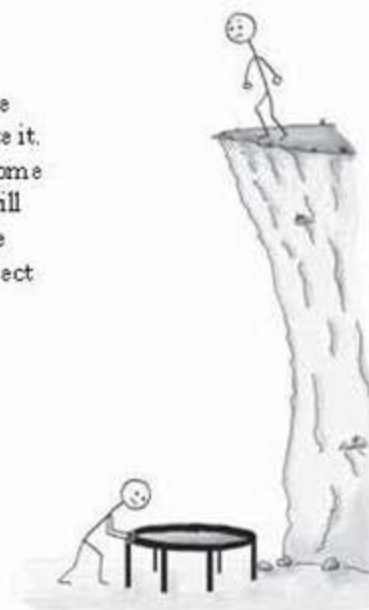
The easiest way to avoid this risk is to walk away from the cliff... but that may not be an option on this project.



2

Mitigate

If you can't avoid the risk, you can mitigate it. This means taking some sort of action that will cause it to do as little damage to your project as possible.



3

Transfer

One effective way to deal with a risk is to pay someone else to accept it for you. The most common way to do this is to buy insurance.

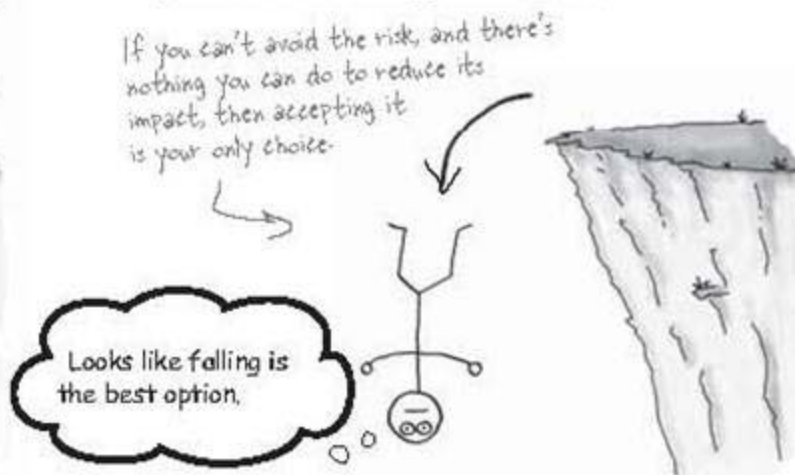


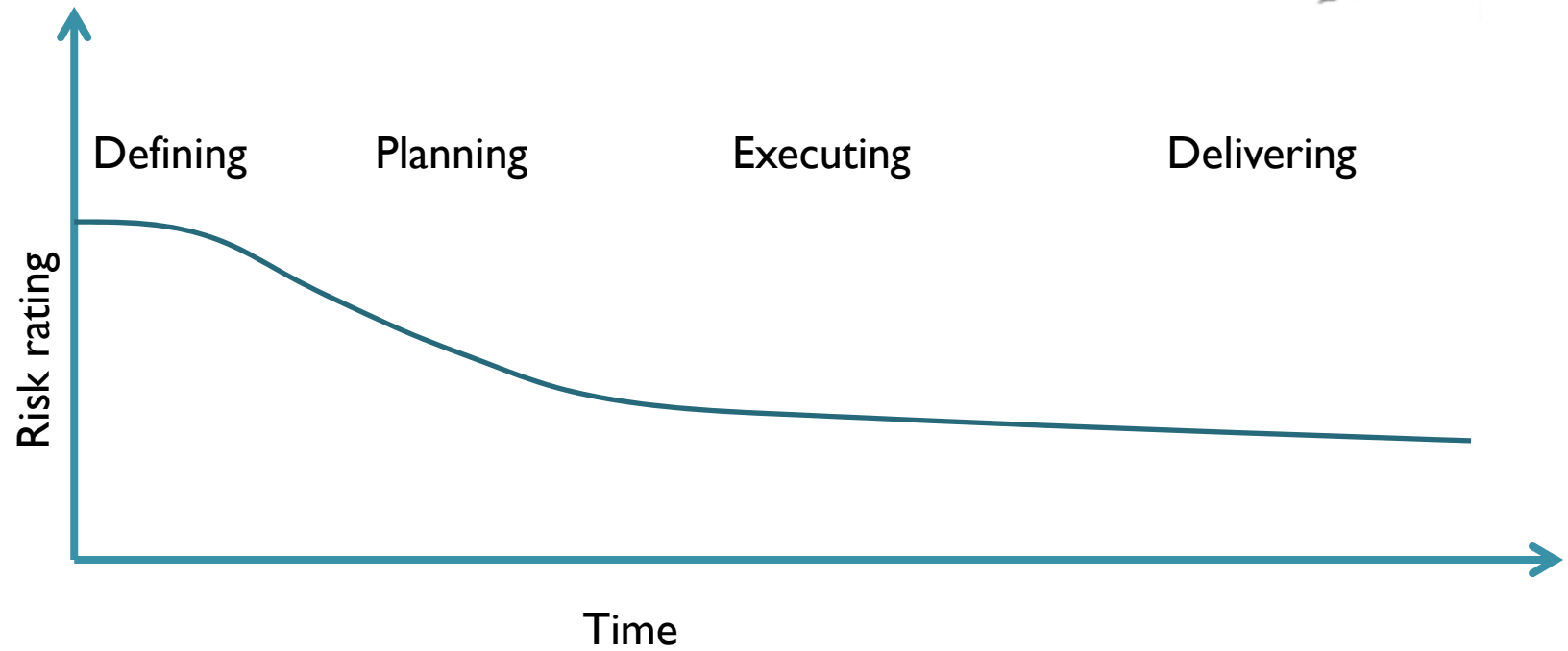
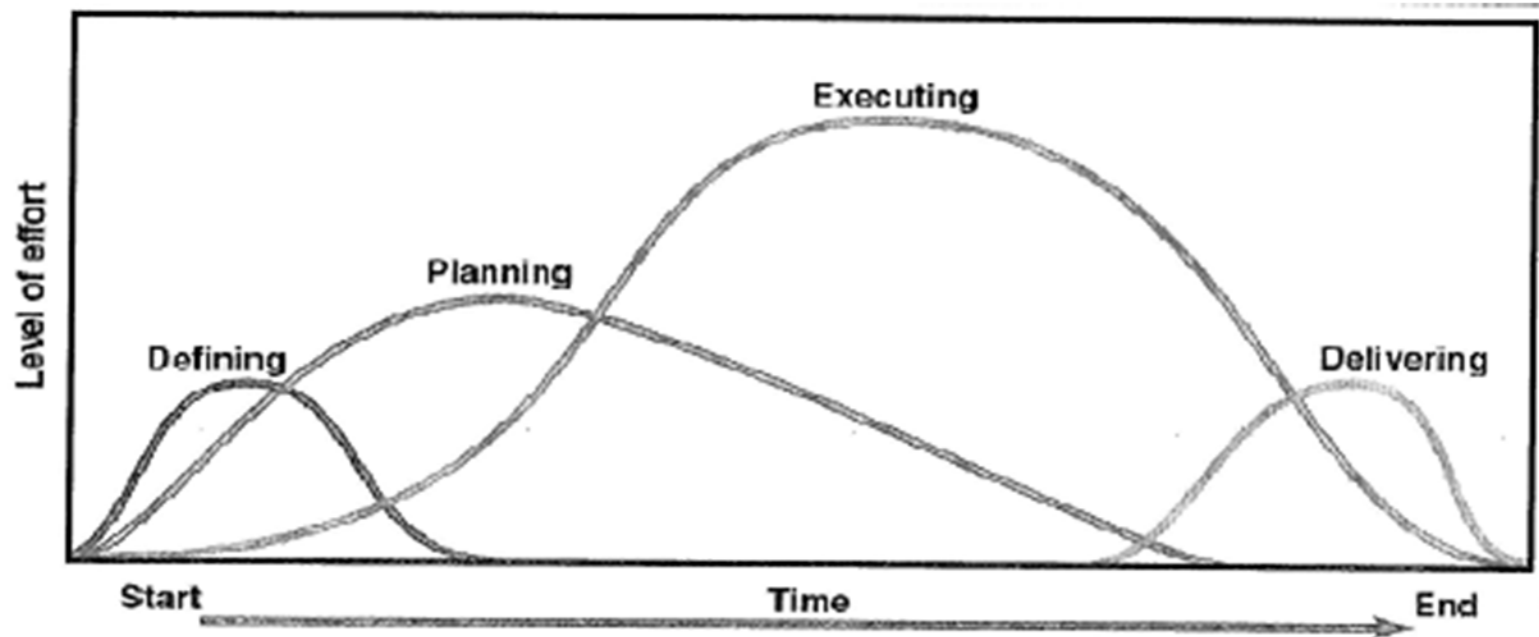
4

Accept

When you can't avoid, mitigate, or transfer a risk, then you have to accept it. But even when you accept a risk, at least you've looked at the alternatives and you know what will happen if it occurs.

If you can't avoid the risk, and there's nothing you can do to reduce its impact, then accepting it is your only choice.







Risk Assessment Questions

- **What can go wrong?**
- **What is the likelihood that it would go wrong?**
- **What are the consequences?**

Risk mitigation Question

- **What can be done to reduce or eliminate risks**



Risk assessment

CpE 190 and EEE 193A
Week 6