CS445 / ECE451 / CS645 / SE463

Software Requirements Specification & Analysis

Risk Management

Risk

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- has a likelihood to occur
- has consequences
- product-related risks
- process-related risks

No Risk, No Reward

Trying to completely eliminate risk from your software project is unrealistic and can be prohibitively expensive.

> “Gain is commensurate with risk.”
>
> *M.K. Soni*

> “He who doesn’t risk never gets to drink champagne.”
>
> *Russian Proverb*

> “Don’t be afraid to take a big step when one is indicated. You can’t cross a chasm in two small steps.”
>
> *David Lloyd George*

Risk Exposure

Risk Exposure is an expression of the degree of risk

RE = prob(occurrence) X cost(consequences)

The risk exposure determines whether it makes sense to take action to reduce risk or mitigate consequences.

Running Example

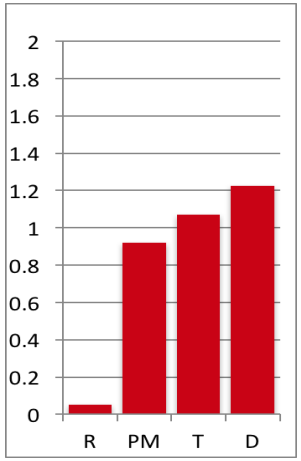
What is the likelihood that any of the following risks might problems for your project (0%-100%)?

- **Requirements** (incomplete, incorrect, ambiguous, changing)
- **Project Management** (estimations, project, team management)
- **Technical** (complex problem, lack of experience with technology)
- **Dependencies** (on adjacent systems, components, other people)

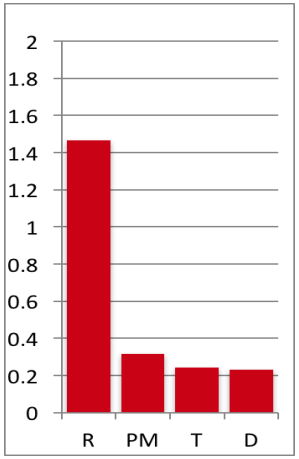
For each risk, if realized, what would be the maximum impact on your ability to create a product that users would like (0%-100%)?

For each risk, if realized, what would be the maximum impact on your ability to complete the project on time (0%-100%)?

Risk Exposure



Team A



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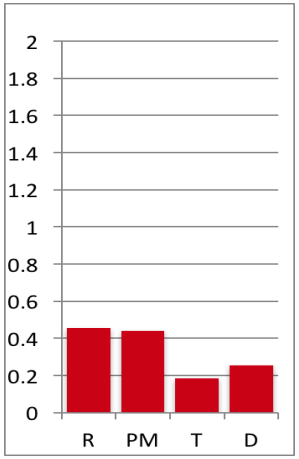

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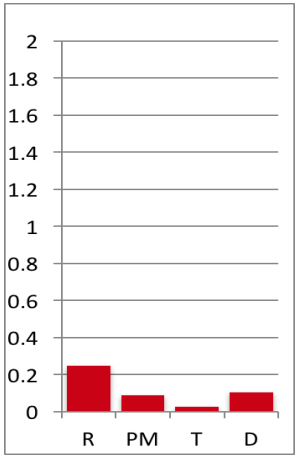

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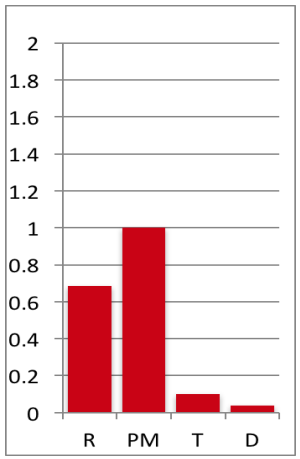

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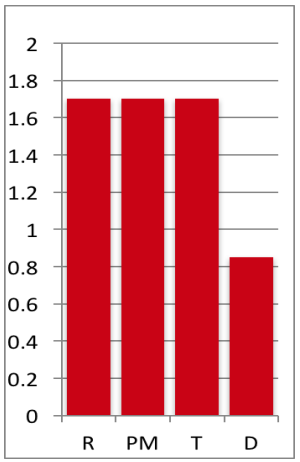

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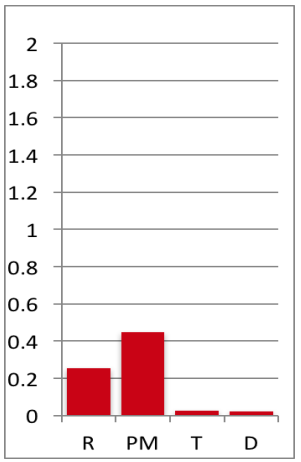
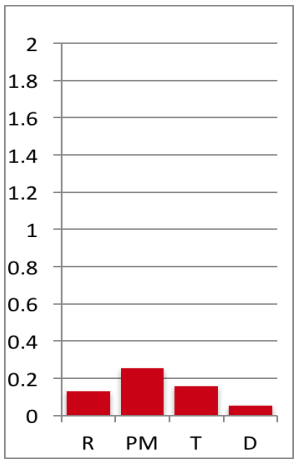
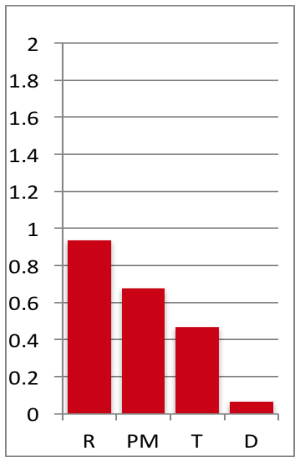


Team G



Team H



Team I

Risk Consequence Table

		Risks (Failure Modes)				
Requirements	**Weight (req)**	**Requirements** (incomplete, incorrect, ambiguous, changing)	**Project Management** (estimations, project, team management)	**Technical** (complex problem, lack of experience with technology)	**Dependencies** (on adjacent systems, components, other people)	**Loss of Objective**
Likelihood (risk)		**0.2**	**0.6**	**0.2**	**0.1**	
Creating a product that users would like	**0.7**	0.8	0.5	0.8	0.7	**0.483**
Completing the product on time	**1.0**	0.7	0.8	0.5	0.8	**0.8**
Risk Criticality		**0.252**	**0.69**	**0.212**	**0.129**	

Impact(risk, req) = estimate of loss of requirement

0 = no loss

1 = total loss

Risk Criticalities

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$$\text{Criticality(risk)} = \text{Likelihood(risk)} \times \sum_{\text{req}} \left(\text{Impact(req,risk)} * \text{Weight(req)}\right)$$

Tall Poles

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Tall Poles

Tall Poles are the most critical risks, having the most severe consequences

Loss of Objective

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Risk-Driving Requirements

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Risk-driving requirement

Risk-driving requirements are the requirements that are most at risk of not being achieved.

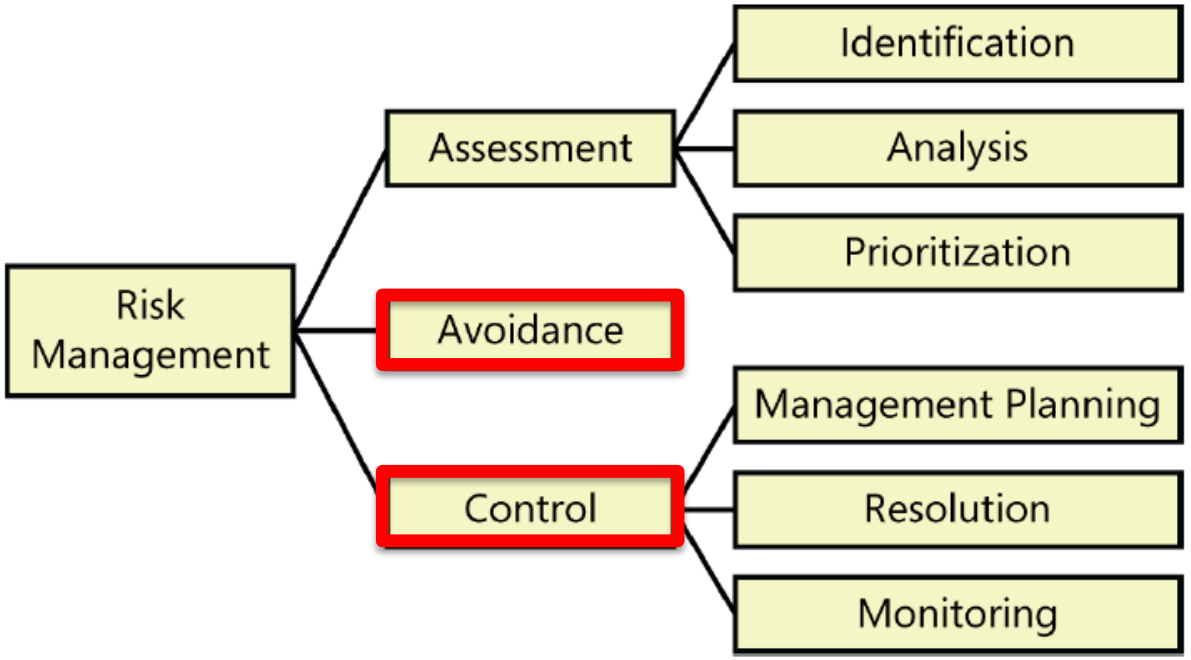
Risk Management

"Risk is like fire: If controlled it will help you; if uncontrolled it will rise up and destroy you."

Theodore Roosevelt

Risk Management

Risk Management attempts to manage the degree to which a project is exposed to risks of quality, delay, or failure.



K. Wiegers and J. Beatty, Software Requirements 3ed, Microsoft Press, 2013.

Countermeasures

"One thing that makes is possible to be an optimist is if you have a contingency plan for when all hell breaks loose."

Randy Pausch

Risk Countermeasures Table

	Risks (Failure Modes)				
Countermeasures	**Requirements** (incomplete, incorrect, ambiguous, changing)	**Project Management** (estimations, project, team management)	**Technical** (complex problem, lack of experience with technology)	**Dependencies** (on adjacent systems, components, other people)	**Overall single effect of countermeasure**
Criticality (risk)	**0.252**	**0.69**	**0.212**	**0.129**	
Collaborative elicitation process with extensive user involvement; modelling; mock-ups	0.5	0.3	0	0.1	**0.3459**
Continually estimate costs; use shorter development iterations	0	0.7	0.2	0	**0.5254**
Prototype novel or risky requirements; plan time for learning and experimentation	0.5	0.3	0.6	0.1	**0.4731**
Investigate suppliers; monitor their progress; develop backup plans	0	0	0.1	0.5	**0.0857**
Combined Risk Reduction	**0.75**	**0.853**	**0.712**	**0.595**	

Risk Countermeasures Table

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Effect(cm, risk) = estimate of reduction of risk

0 = no reduction

1 = risk eliminated

Combined Reduction

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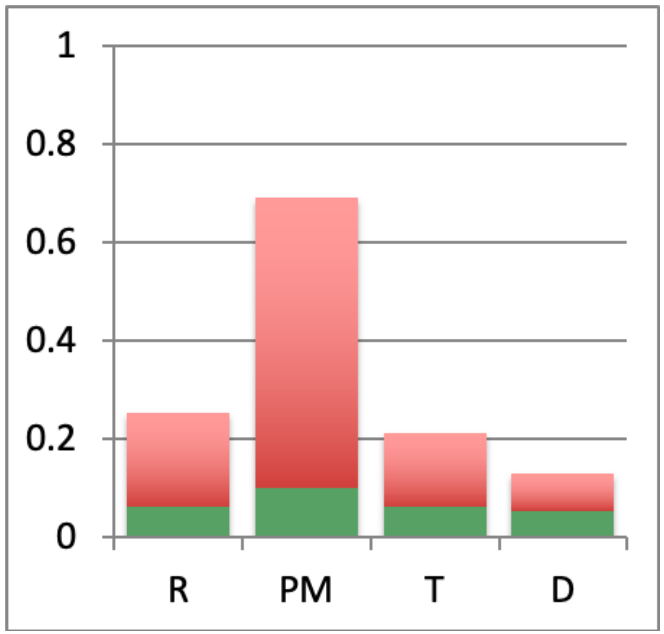
$$\text{CombinedReduction}(risk) = 1 - \prod (1 - \text{Reduction}(cm, risk))$$

Combined Reduction

For each risk

- Red columns reflect original risk criticalities
- Green column reflect maximally reduced risk criticalities



Tall Poles

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Overall Effect of Countermeasures

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$$\text{OverallEffect}(cm) = \sum \left(\text{Reduction}(cm,risk) * \text{Criticality}(risk)\right)$$

Most-Effective Countermeasures

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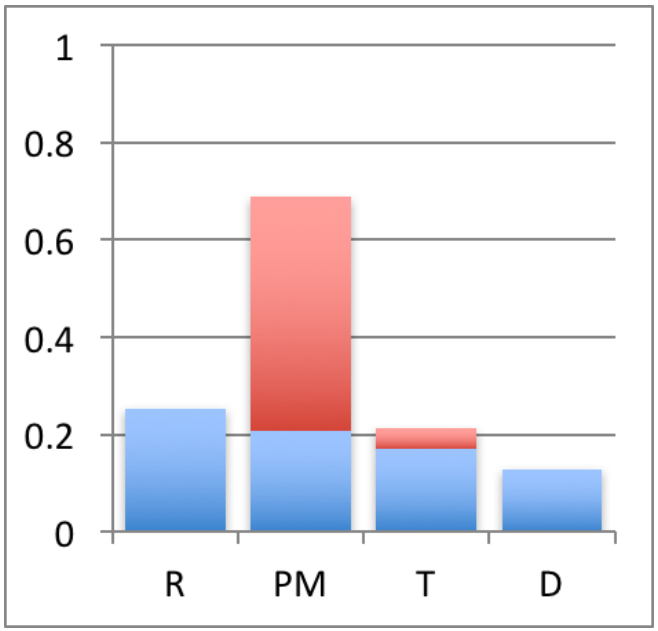
most-effective countermeasure

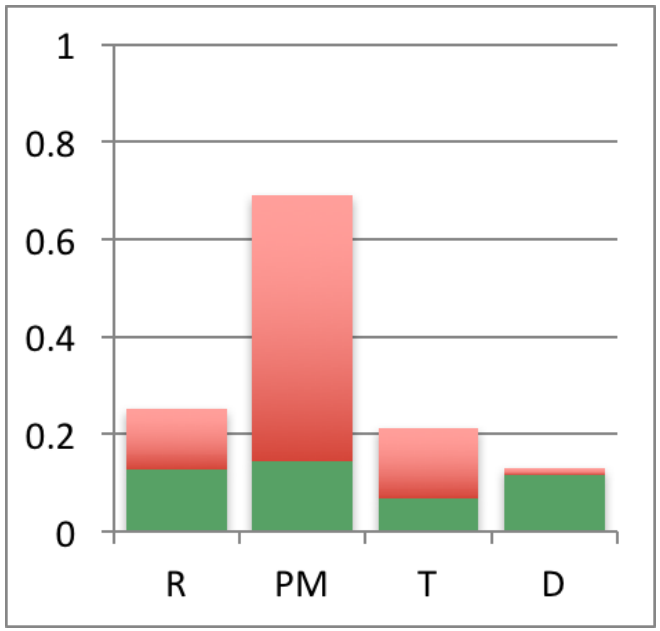
Apply Optimal Countermeasures

Red bars show the risk criticalities before mitigation.

Blue bars show risk criticalities after 1 mitigation

Green bars show the risk criticalities after 2 mitigations.





References

J. D. Kiper and M. S. Feather, "A Risk-Based Approach to Strategic Decision-Making for Software Development," in *Proceedings of the 38th Annual Hawaii International Conference on System Sciences*, 2005.

Karl E Wiegers and Joy Beatty. *Software Requirements, 3ed*. Microsoft Press, 2013.

Chapter 32: “Software Requirements and Risk Management”