SCS 3208 - Software Project Management

Topic 4
Risk Management

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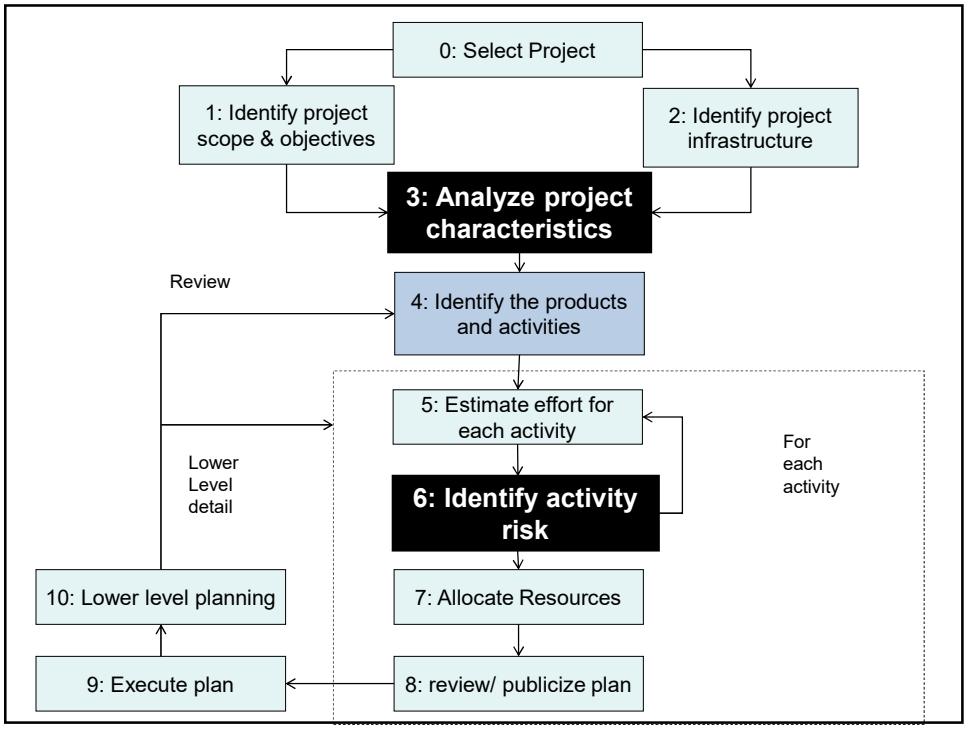

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Intended Learning Outcomes

- At the end of this topic, you'll be able to;
  - **Identify** potential risks in software projects
  - **Categorize** and **prioritize** risks
  - **Quantify** the likely effect of risks
  - **Decide** on the risk **actions**
  - **Make plans** to deal with risks

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What is a risk?

- An uncertain event or condition that has an effect on the project objectives.
- An unforeseen event that can cause a negative or positive impact on the project's cost, schedule, or quality.
- Relates to the future
- Measured in terms of probability of occurrence (high-low) and consequences (loss: high-low)
- Involves cause and effect
- Risk Categories
  - Known/Predictable/Unpredictable

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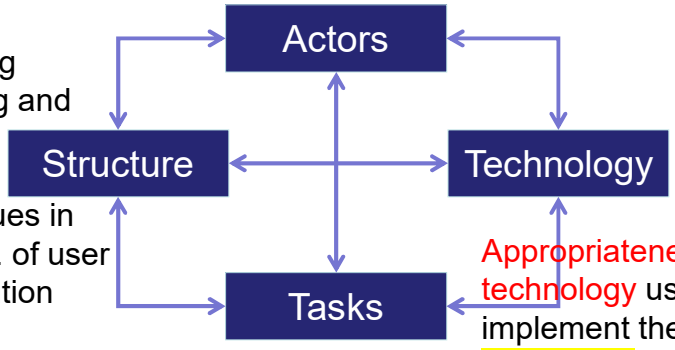
Categorizing Risk

Refers to all people Involved in the development e.g. high staff turnover > loss of expertise

Management structure and system. Including planning and control

e.g. issues in the mgt. of user contribution



Relates to work planned.
Eg. Complexity might lead to delays

Appropriateness of technology used to implement the application and faults that embedded in the delivered product

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Risk Management (RM)

- An attempt to minimize the chances of failure caused by unplanned events/risks.
- Aim to identify, quantify and take actions to minimize the effect of risks on the project
- Risk management involves additional cost
  - RM is cost effective only if the cost of RM is considerably less than the loss incurred
- It's not easy to measure the value of RM.
- Involves two key components:
  - risk assessment and
  - risk control

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A framework for dealing with risks

1. Risk identification
2. Risk estimation (analysis and prioritization)
3. Risk planning
4. Risk monitoring
5. Risk resolution

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Risk Identification

- Two main approaches;
  1. Checklist
     - Lists a set of risks that have been found more likely to occur and
     - Suggests countermeasures for each risk
  2. Brainstorming
     - Representatives of the main stakeholders discuss and identify the problems that might occur

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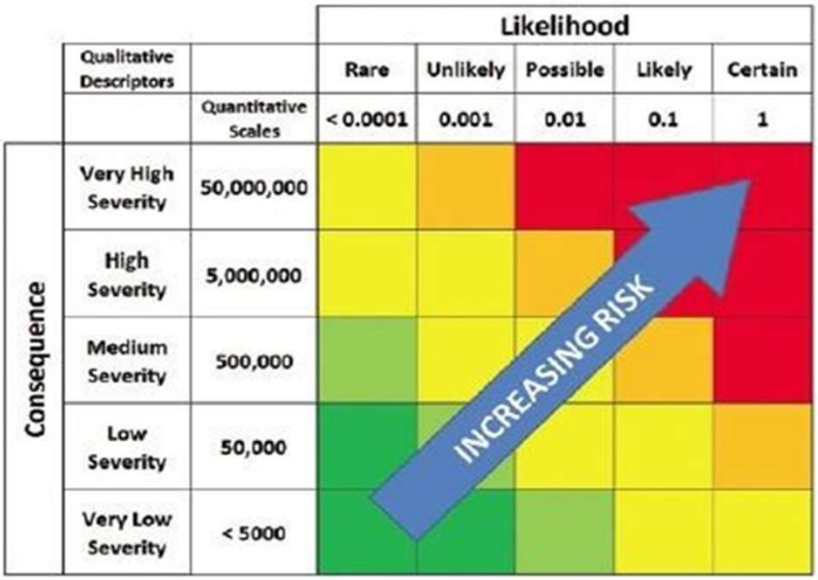
Risk Assessment



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Risk Assessment

- Risk Exposure: ***Expected Value*** of the loss for the risk

  Risk Exposure = Risk Likelihood x Risk Impact

  RE(R) = Prob(R) x Loss(R)

- Risk Likelihood: The probability of a risk.
- Risk Impact: The total loss incurred if the risk happens.

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Risk Assessment Contd….

- E.g.

A project depends on a data center which is vulnerable to fire. It is estimated that there is a 1 in 1000 chance fire actually happening. If a fire occurred a new computer configuration could be established for Rs.500,000. Find the risk exposure.

RE= Rs.500,000x1/1000 =Rs.500
This is the minimum sum an insurance company would require as a premium.

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Calculating Risk Exposure

Factor	P	C	RE
Late delivery from COTS vendor ACME	0.25	28 days	7 days
ACME API integration delay	0.6	15 days	9 days
Additional unit testing needed; 3% more classes than first estimated	0.9	20 days	18 days
Beta test group reports that they may not be able to fit us into their pipeline until May 1 instead of April 1	0.5	30 days	15 days
TOTAL RISK EXPOSURE			49 days

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Qualitative Method of Risk Estimation

Probability	Range
High	Greater than 50% chance of happening
Significant	30-50% chance of happening
Moderate	10-29% chance of happening
Low	Less than 10% chance of happening

Qualitative descriptors of risk probability and associated range values

Impact Level	Range
High	More than 30% above budget expenditure
Significant	20-29% above budget expenditure
Moderate	10-19% above budget expenditure
Low	Within 10 % of budget expenditure

Qualitative descriptors of impact on cost and associated range values

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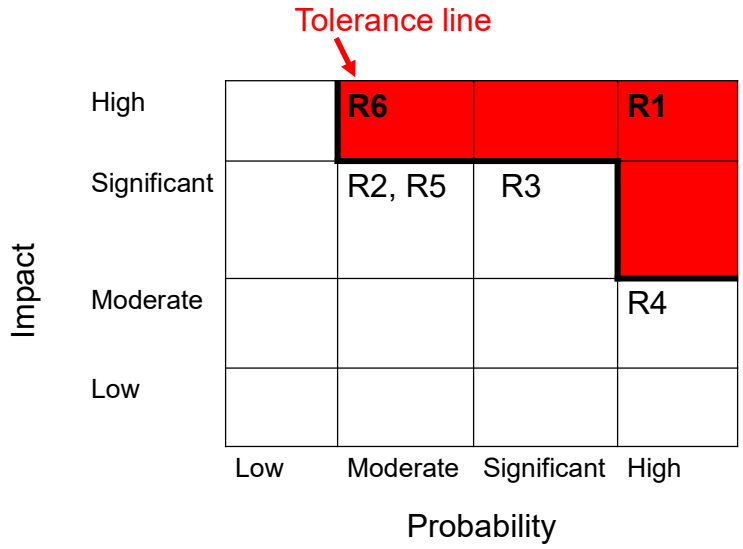
A probability impact matrix



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Risk Planning

How to deal with risks?

- **Risk Acceptance (Tolerate)**
  - Approval of operations under exposure to the risk, according to the organizations policies and criteria for risk acceptance
  - Should also involve provision for recovery under business continuity management
- **Risk Avoidance (Terminate)**
  - Changing of re-engineering the business process
  - Terminate the activity giving rise to risk

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Risk Planning …contd.

- **Risk Reduction (Treat)**
  - Application of security controls
  - Treat risk with appropriate control measures and mechanisms
- **Risk Transfer**
  - Transfer the risk to another party
  - Insurance or outsourcing

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A framework for dealing with risks

1. Risk identification
2. Risk estimation (analysis and prioritization)
3. Risk planning
4. **Risk monitoring and resolution**

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Maintaining the Risk Register

RISK RECORD					
Risk id		Risk title			
Owner		Date raised		Status	
Risk description					
Impact description					
Recommended risk mitigation					
Probability/impact values					
	Probability	Impact			
		Cost	Duration	Quality	
Pre-mitigation					
Post-mitigation					
Incident/action history					
Date	Incident/action		Actor	Outcome/comment	

- Refer to the project plan and record the most threatening risks in a risk register.
- After starting the project, all emerging risks need to be added.
- Review and amend the register at regular intervals.
- Close the entry once the relevant risky activities are completed.

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Deciding Risk Reduction Action

- Risks that cannot be avoided or reduced immediately can have more than one countermeasure.
  - Consider Cost vs. Benefits
- Risk Reduction Leverage (RRL)- measures the ROI or the risk reduction technique

$$RRL = \frac{RE\ before - RE\ after}{Risk\ Reduction\ Cost}$$

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Example: Use of RRL

$$RRL = \frac{2500 - 150}{40000} = 0.059$$

Risk		Probability of occurring	Total loss if it occurs	Risk Exposure	
Competitive strike		10%	25K	2500	
Countermeasure	**Total cost**	**New risk probability**	**New total loss**	**New RE**	**RRL**
Advertising campaign	40K	3%	5K	150	0.059
Price promotions	30K	5%	10K	500	0.067
Simultaneous launch	10K	8%	15K	1200	0.13

Highest RRL indicates most cost-effective countermeasure

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Activity

•ABA association needs to find the total risk exposure to their project. The following table lists two major risks that ABA has identified, the probability of each risk, and the estimated delay each can cause. Complete the following table by calculating the total risk exposure.

Risk Factor	**Probability**	**Delay (Days)**	**Risk Exposure**
1. Delay in purchasing required software to develop the media elements	0.8	45	
2. Video recording delay	0.5	15	
Total risk exposure			

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The following table lists some countermeasures identified to reduce the impact of the risks described in question 3(b). Suppose that the organization has to spend Rs 1000 per delayed date. Calculate the Risk Reduction Leverage of each solution and complete the following table.

	Countermeasures	**Cost (Rs.)**	**New Risk Probability**	**New total delay**	**New Risk Exposure (days)**	**Risk Reduction Leverage**
1.	A. Start the procurement process early by spending the deposits.	10,000	0.6	30 days		
	B. Obtain software from software-as-a service	50,000	0.7	35 days		
2.	C. Hire expert cameraman	75,000	0.3	7 days		
	D. Recruit another cameraman	50,000	0.4	10 days		

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Evaluate the effects of uncertainty

- Techniques to take account of the uncertainties in the duration of activities within a project
  - PERT (Program/Project Evaluation Review Technique)
  - Monte Carlo /Probability simulation
  - Critical Chain Management

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Using PERT

- Most likely time (m)
- Optimistic time (a)
- Pessimistic time (b)
- (Single) Expected time (t_e)

$t_e = (a + 4m + b)/6$

- Activity Standard Deviation (s)

$s = (b - a)/6$

$s \propto (b-a)$ is used to rank the measure of degree of uncertainty or risk of activity

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Exercise 1

Activity	a (wk)	m (wk)	b (wk)	t_e (wk)	s (wk)
A	5	6	8	6.17	0.50
B	3	4	5	4	0.33
C	2	3	3	2.83	0.17
D	3.5	4	5	4.08	0.25
E	1	3	4	2.83	0.50
F	8	10	15	10.5	1.16
G	2	3	4	3	0.33
H	2	2	2.5	2.08	0.08

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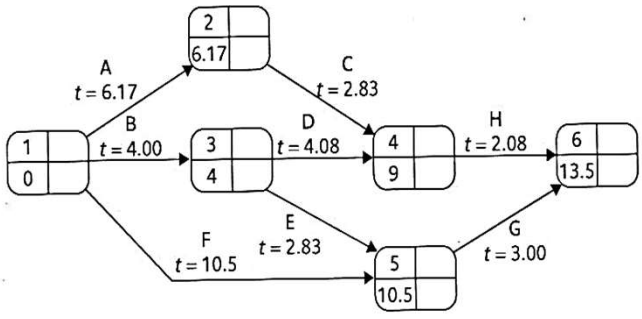
Calculating expected duration

- Use the same method as in the CPM technique
- Carry out forward pass through a network
- Calculated event dates are the dates by which we expect to achieve those events

Event Number	Target date (T)
Expected date (Te)	Standard deviation



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Finding Standard Deviation for each project event

- Use forward pass method
- The standard deviation of the first event is always 0
- When there are 2 SDs to be considered in a path, then SD =$\sqrt{SD1^2 + SD2^2}$
- If an event has only one path (depends only on one activity), the standard deviation of the event is the same as the standard deviation of the activity.
- If there is more than one path, calculate the SD for each path and select the highest SD.

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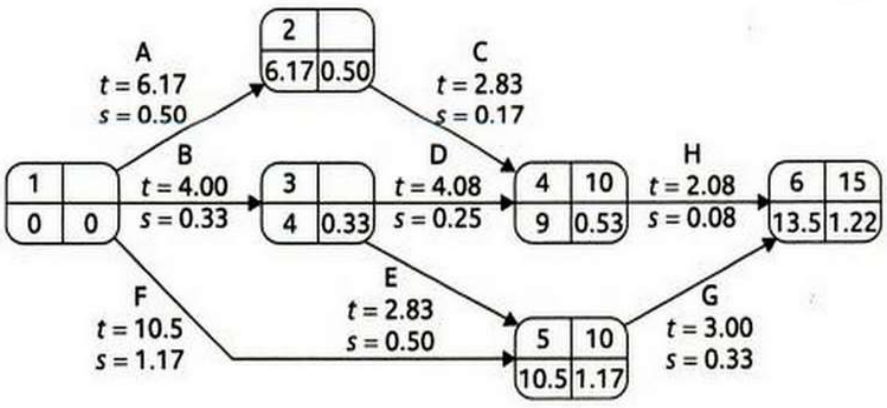
Completed PERT Network



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Probability of meeting/missing targets

- The entire project as well as events may have target dates. Also, certain tasks may have to be completed by a target date
- Three step method of calculating the probability of meeting/missing the target.

1. **Calculate the standard deviation for each event**
2. **Calculate the z value for each event having a Target Date**
3. **Convert the z values into probabilities**

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Calculating z value

- Calculated for each node that has a target date
- Equivalent to the number of standard deviations between node's expected and target dates

EN	T
Te	S

$$z = (T_{target} - T_{expected}) / s$$

e.g., Z value for event 6 is;
Z = (15-13.5)/1.22 = 1.23

6	15
13.5	1.22

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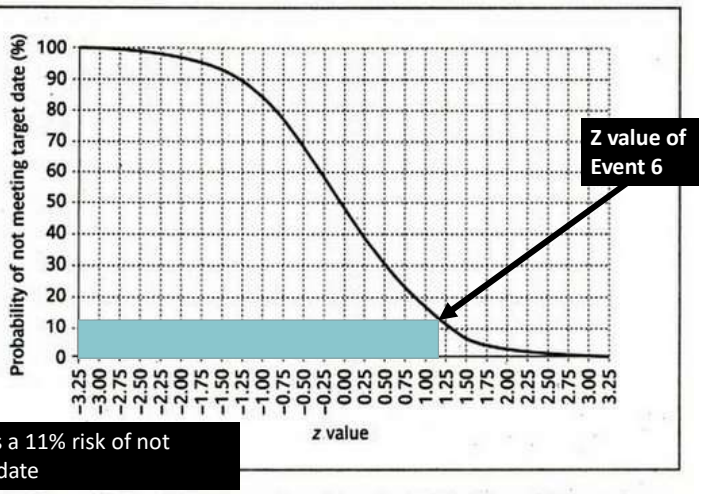
Convert z value into probability

This graph is the equivalent of tables of *z* values, also known as standard normal deviates, which may be found in most statistics textbooks.



For event 6, there is a 11% risk of not meeting the target date

FIGURE 7.8 The probability of obtaining a value within *z* standard deviations of the mean for a normal distribution

In MS Excel, use =(1-NORM.S.DIST(z,TRUE))*100

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Exercise 2

- Calculate the z values for each of the events 4 and 5 and find the probability of missing the target dates.

4	10
9	0.53

5	10
10.5	1.17

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Exercise 3

(a) Calculate the T_e and S (b) Draw the PERT chart (c) Explain the possibility of meeting the following target dates.

Target Dates: Project completion: 46, Event 5: 30 & Event 6: 38

Activity	Dependency	T_a	T_m	T_b	T_e	S
A	-	8	10	12		
B	A	5	7	9		
C	A	1	2	3		
D	B	6	8	10		
E	C, D	2	3	5		
F	-	11	13	17		
G	E, F	4	6	8		
H	G	9	11	14		

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Exercise 4

- Describe the pros and cons of using PERT technique to identify project risks.

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