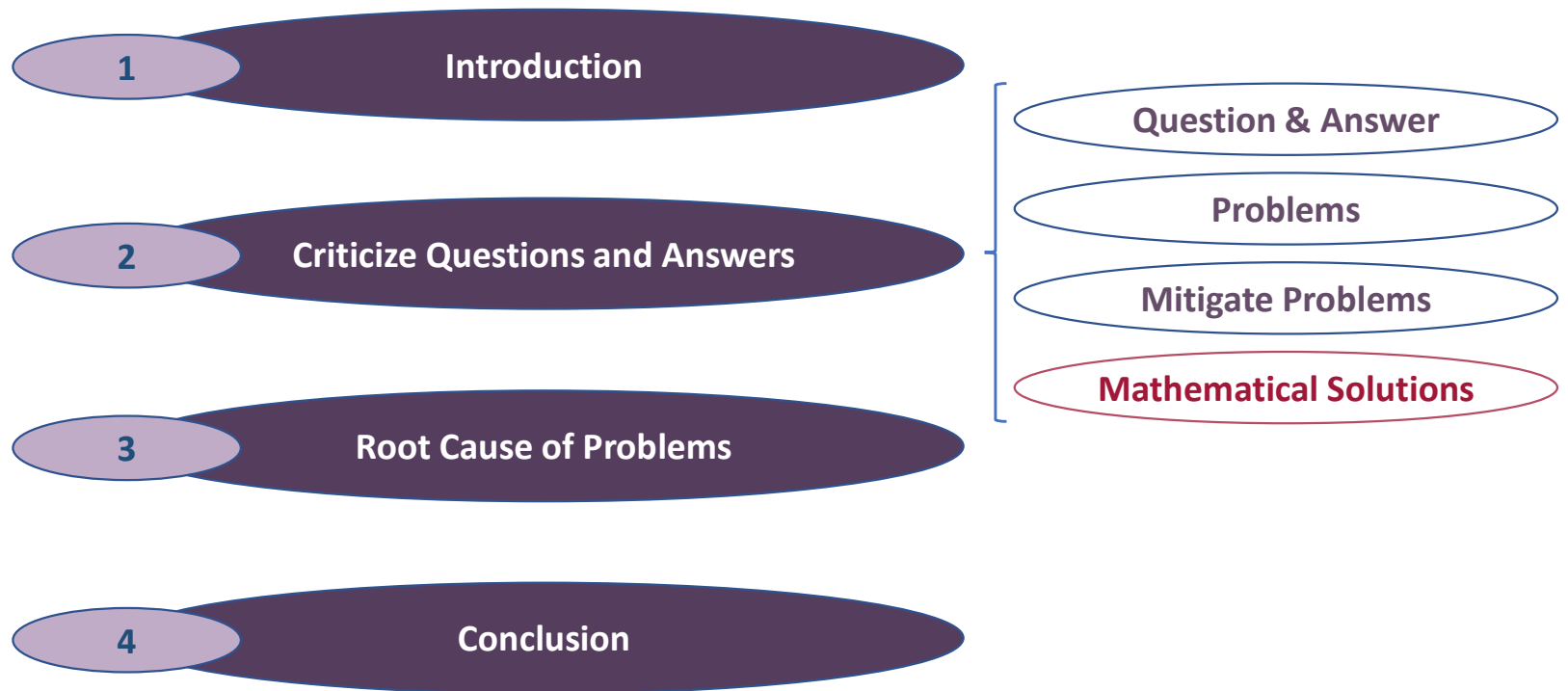# Challenges of Calculating Schedule Impact of Individual Risks on a Project

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Content

Introduction

Introduction

Objective

Introduce some common misalignments in current risk analysis procedures and software and propose solutions to improve them.

Criticize Current Practices

Reviewing prevailing ways taken by project risk practitioners, following problems are usually found:

- ❑ **Deterministic mindset in probabilistic environment.**
- ❑ **Inconsistency of questions and answers.**
- ❑ **Inaccuracy of answers/results.**

Introduction

Main Questions

Priority of Each Risk

Impact of Each Risk

Usual Ways to Answer Questions

Correlation

Duration Impact
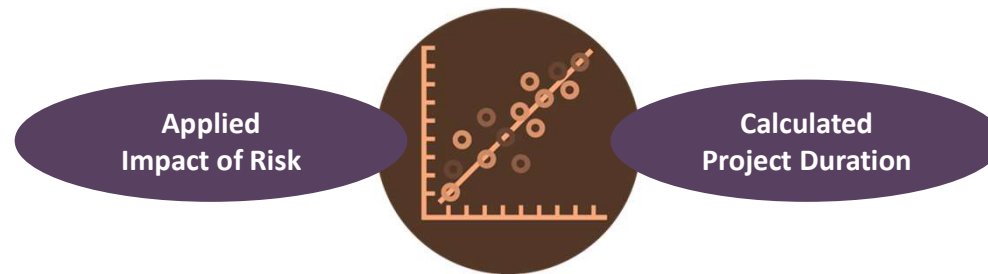
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Criticize First
Question & Answers

First Question and Answer

How are risks prioritized?

Correlation: The best way to answer this question is using statistical concept of Correlation.

Iteration	1	2	3	4	...	998	999	1000
Risk Impact	0%	90%	50%	30%	...	100%	80%	20%
Project Duration	120d	200d	170d	150d	...	200d	190d	150d

Spearman Method:

$$R = 1 - \frac{6 \cdot \sum d^2}{n(n^2 - 1)}$$

$$-1 <= C <= 1$$

Pearson Method:

$$r = \frac{\frac{\sum(x - \bar{x})(y - \bar{y})}{n - 1}}{\sqrt{\frac{\sum(x - \bar{x})^2}{n - 1}} \cdot \sqrt{\frac{\sum(y - \bar{y})^2}{n - 1}}}$$

Applied Impact of Risk

Calculated Project Duration

Criticize Answer of First Question

First Problem: Negative Correlation

MEANING:

By increasing risk impact, project duration is dropped**!!!**

Reason

Inherent concept of Simulation:

In some iterations, this risk has been applied with lower impact range, whereas other risks have been applied with higher impact ranges. So, when this risk has a lower impact, project duration is higher; and when this risk has a higher impact, project duration is lower.

Iteration	Risk 1 Impact	Risk 2 Impact	Total Duration
1	70% = 25.2	50% = 4.5	85.2
2	80% = 28.8	10% = 0.9	88.8
3	20% = 7.2	20% = 1.8	67.2
4	10% = 3.6	40% = 3.6	63.6

Correlation of Risk 1 and total duration: **-0.16**

Action

- Disregard negative correlations or consider them with value of zero.
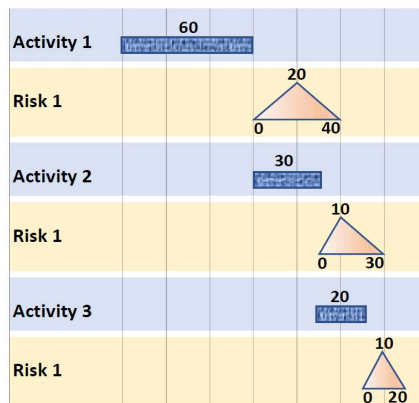
- A mathematical solution.

Criticize Answer of First Question

Second Problem: A Risk with Different Impacts on Several Activities

Different impact of one risk on several activities

final correlation of this risk?

Correlation for pair of risk and activity

Correlation of R1-A1 and total duration: **0.74**

Correlation of R1-A2 and total duration: **0.51**

Correlation of R1-A3 and total duration: **0.44**

Action

A mathematical solution.

Criticize Answer of First Question

Third Problem: Satisfying Deterministic Thought of Audiences

Project team members and managers are usually looking for time impact of risk instead of its correlation.

Not Compatible with Probabilistic Thinking

Inaccurate Question for Probabilistic Analysis

BUT

Satisfying Project Team Member

Action

Second question is arising. (refer to next slide)

Criticize Second
Question & Answers
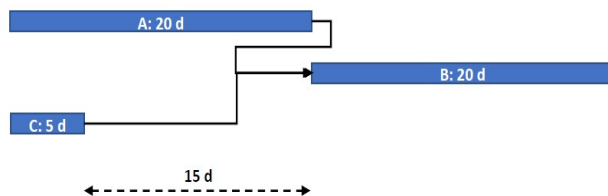
Second Question- First Answer

What is schedule impact of each risk on project?

First Answer to Second Question

Assign risks one by one to project while other risks are not there and run simulation to find impact of each risk.

Problems

1- It is not realistic because in real world, all risks affect project altogether instead of one by one.

2- In some networks, perhaps risks don't affect individually but can affect together.

Assume 2 risks with maximum impact of 10 days have been assigned to activity C. Calculating impact of each risk with above method, both will be 0. However, If they happens together in actual, will affect project.
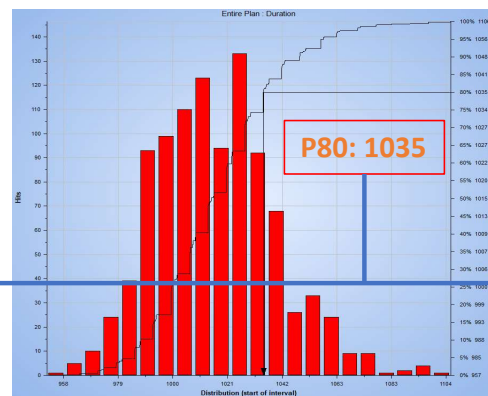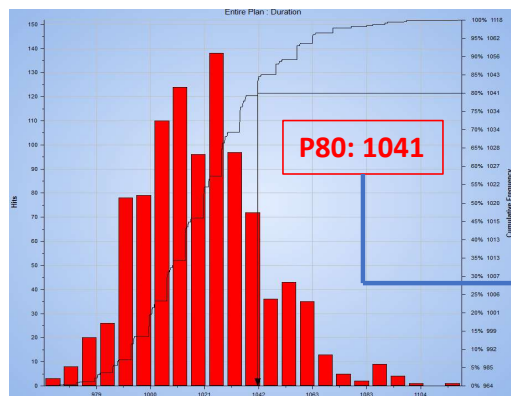
So, this answer is not right

Second Question- Second Answer

What is schedule impact of each risk on project?

Second Answer to Second Question

Remove each risk while other risks are there and run simulation to find impact of this risk on a certain P(n). The process is as follows:

1- Consider one of the P(n)s like P80.

2- Run simulation with all risks and take P80 duration of project.

3- Remove selected risk and run simulation with all other risks and take P80 duration of project.

4- Consider difference of P80 of second step and P80 of third step as impact of this risk on P80 duration of project.

P80: 1041

P80: 1035

Risk Impact = 1051-1035 = **6**

Second Question- Second Answer

Problems

- The process by which risk impact is achieved is not aligned with statistical concept of building risk impact range.
- The process of removing risks while other risks are there, is not realistic.

In fact, by this way, impact of each risk on P(n) (for example P80) date of project is calculated. So, this is answer of another question which is :

What is schedule impact of each risk on P(n) (for example P80) date of associated project?

So, this answer is not consistent with question

Action

- Third question which is an imprecise question is arising. (refer to next slide)
- A mathematical solution
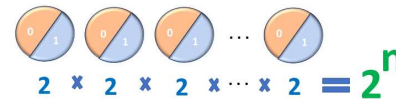
Second Question- General Problem

What is schedule impact of each risk on project?

General Problem

There are several risks with following realities:

1- Each risk may happen or may not happen

2- Time of happening risks are different

3- Date of activities affected by each risk is different

There can be many potential scenarios of occurring / not occurring risks. The number of scenarios is:

$$2 \times 2 \times 2 \times \cdots \times 2 = 2^n$$

For example, for a project with 20 risks, there will be 1,048,576 scenarios.

But in all answers only one scenario is evaluated. So, chance of happening the selected scenario is very low. So, inherent characteristic of probabilistic analysis has not been considered.

Action

Knowing that this question is a deterministic question and is not aligned with probabilistic approach, to satisfy audiences, can use third answer.

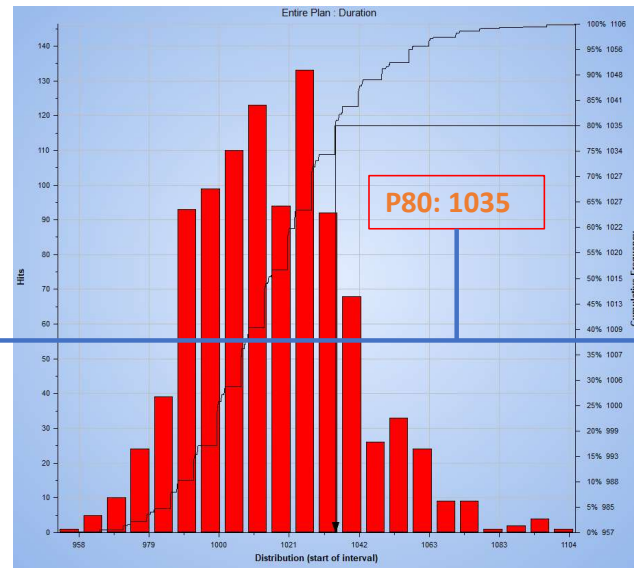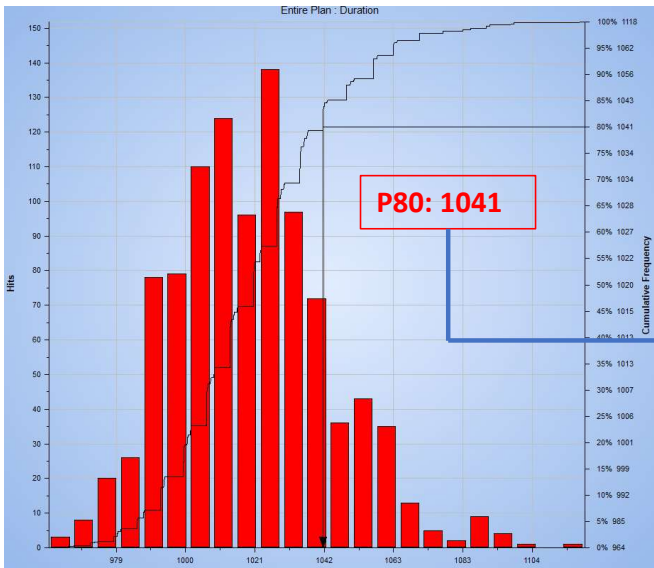# Criticize Third
Question & Answers

Third Question and Answer

What is schedule impact of each risk on Pn date of associated project?

Answer

This question was created and answered in second answer of second question as follows:

P80: 1041

P80: 1035

Risk Impact =
1041-1035 =
6

Third Question and Answer

First Problem

This question is not compatible with probabilistic approach (with the same descriptions in Slide No 15).

Action to First Problem

Knowing that this question is a deterministic question and is not aligned with probabilistic approach, to satisfy audiences, can use it.

Second Problem

Project team members usually expect to realize that sum of all risks' impact is equal to difference of project duration before and after risk analysis.

Action to Second Problem

Either Justify project team members that this expectation is not aligned with probabilistic concept behind risk analysis, or do followings:

To reach to deterministic duration, all risks should be removed. So, risks can be removed one after another (removed risk is not back again) and difference of P(n) duration is achieved after removal of each risk and considered as impact of that risk.

In fact, a new question is built here which is Fourth question.
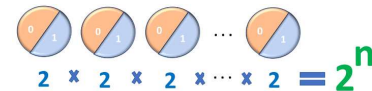
Fourth Question and Answer

How long is saved in case of mitigating risks one after another with a predefined order?

Answer

1- Prioritize project risks based on their Exposure Window

2- Consider one of the P(n)s like P80.

3- Run simulation with all risks and record P(n) duration of project.

4- Remove prioritized risk one after another (removed risk is not back again) ; run simulation; and record P(n) duration of project.

5- Consider difference of P(n) duration before and after removing this risk as its P(n) duration impact.

6- Repeat steps 4 and 5 until all risks are removed.

Problems

1- This question and its answer are not aligned with intrinsic concept of probabilistic analysis.

2- Order of removing risks changes their impact.

3- It is not completely aligned with real world.

$$2 \times 2 \times 2 \times \cdots \times 2 = 2^n$$

Root Cause of Problems

Rout Cause of Problems

The main roots of misalignments can be as follows:

❖ **Erroneous Approach:**

Deterministic Approach

for Probabilistic Analysis

❖ **Inconsistency:**

Inconsistency of

Questions and answers

❖ **Inaccuracy:**

Inaccurate

answers/results

Approach

> **Deterministic vs Probabilistic Approach:**

A Key Point:

Not to look for deterministic questions and answers while running a probabilistic analysis.

Probabilistic approaches need probabilistic questions and probabilistic answers.

For example, if a project schedule is modeled with probabilistic approach, following question is not applicable:

What is exact time impact (as a deterministic number) of a risk on a project?

But in practical, risk analysts are usually to report deterministic questions/answers to satisfy team members.

Questions

THE ART OF ASKING THE RIGHT QUESTIONS

➢ Right and Precise Questions:

The more precise questions,
the more accurate answers.

How important is each risk in terms of schedule impact on project?

What is schedule impact of each risk on project?

What is schedule impact of each risk on Pn date of project?

How long is saved in case of avoiding risks one after another with a predefined order?

❑ First question is the main question which is compatible with probabilistic approach.
❑ Other questions are arisen from the first (main) question and are not quite compatible with probabilistic approach.
❑ Last question is more correct compared to second and third ones.

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Comparison

Followings are main questions / answers and their level of compatibility with probabilistic approach:

Question		Answer		Comparison		
No	Description	No	Description	Approach	Consistency	Accuracy
1	How important is each risk in terms of schedule impact on project?	1	Correlation	√	√	√
2	What is schedule impact of each risk on project?	1	Assign risks one by one to project while other risks are not there and run simulation to find impact of this risk	X	X	X
		2	Remove each risk while other risks are there and run simulation to find impact of this risk on a certain P(n).	X	X	X
		3	Remove each risk while other risks are there and run simulation. Then build impact range to find P(n)s.	X	√	√
3	What is schedule impact of each risk on Pn (e.g., P80) date of project?	1	Remove each risk while other risks are there and run simulation to find impact of this risk on a certain P(n).	X	√	√
4	How long is saved in case of mitigating risks one after another with a predefined order?	1	Remove risks one after another and run simulation to find impact of this risk on a certain P(n).	√X	√	√

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Conclusion

Conclusion

Probabilistic Mentality

Having a probabilistic mentality is the priority for risk analysis practitioners.

Questions (and expected answers) in deterministic environments are different from those in probabilistic environment.

These questions (answers) can be used as some indicators that give kind of sense to project team members. However, all must know that those are not perfect questions (answers).

Improve Software

There are some areas focusing on which, current probabilistic schedule analysis software can be improved.

Delve into current Procedures and Software, it seems that some improvements are needed at:
- Attitude of practitioners
- Calculation methods and format of reports
- Mathematical solutions

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THANK YOU

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