## 2. Prioritisation and risk analysis

Prioritisation
Likelihood and impact estimation
Risk number
Planning risk and contingencies

## The fundamental problem of testing software

- We cannot test for everything
- No system can be completely tested
- The need to have a clever testing methodology
- One solution: Test prioritisation based on risk analysis



"What you test is more important than how much you test."

Craig and Jaskiel



## Risk driven testing

- Tests need to be prioritised so that the most important bugs are found first
- **Risk driven testing** is the recommended approach
- A dictionary definition of risk (Oxford Concise)

Hazard, chance of bad consequences or loss



## Risk driven testing

Hazard, chance of bad consequences or loss

The probability, or likelihood, of an event occurring

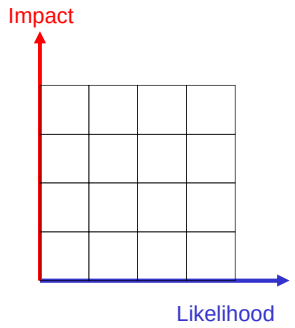
The negative consequences or impact of the event



## The components of risk

- **Likelihood**
  An estimate of how probable is that the piece of a system would fail
- **Impact**
  What would happen if this piece malfunctioned

## The components of risk

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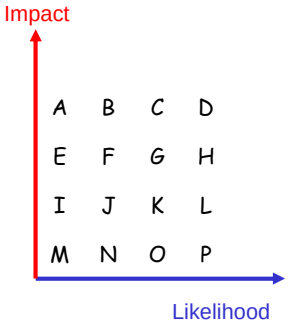
## Prioritisation

- Identify components
- Estimate the likelihood
- Estimate the impact
- Assign numerical values
- Prioritise the tests

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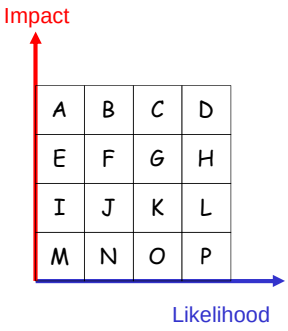


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## Likelihood estimation

"On the scale 1 to 10, how shaky do you think this piece is?"

- Indicators
  - Complexity
  - Number of interfaces
  - Project history (new or modifications)
  - Development team history
  - …
- Who?

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## Impact estimation

"How bad would it be, on a scale of 1 to 10, if this piece did not work correctly?"

- Indicators?
  - Application dependent
- Who?

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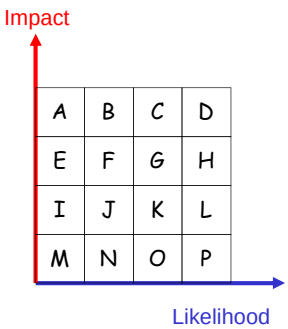
## Prioritisation

- Identify components
- Estimate the likelihood
- Estimate the impact
- Assign numerical values
- Prioritise the tests

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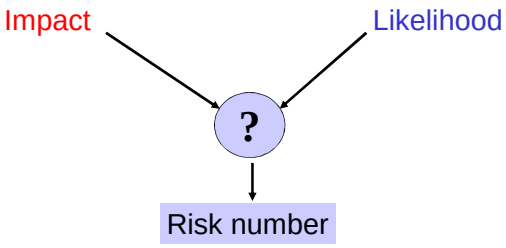
## Risk prioritisation

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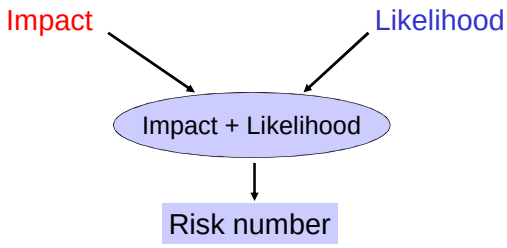
## Risk prioritisation

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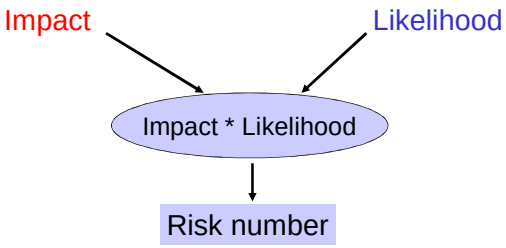
## Risk prioritisation

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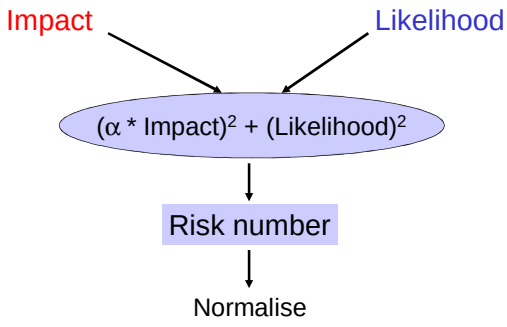
## Risk prioritisation

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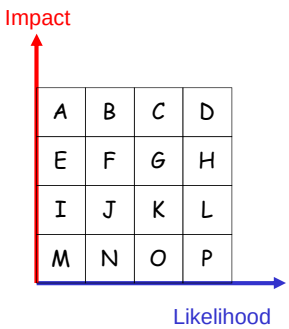


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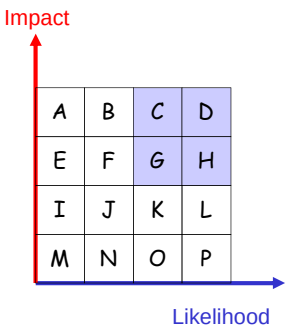
## Prioritisation

1. High impact AND high likelihood

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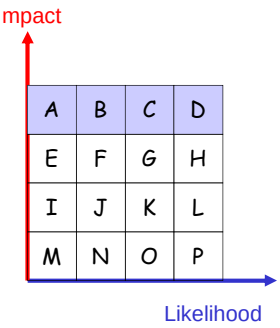
## Prioritisation

1. High impact AND high likelihood
2. High impact

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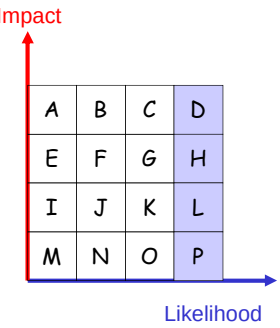
## Prioritisation

1. High impact AND high likelihood
2. High impact
3. High likelihood

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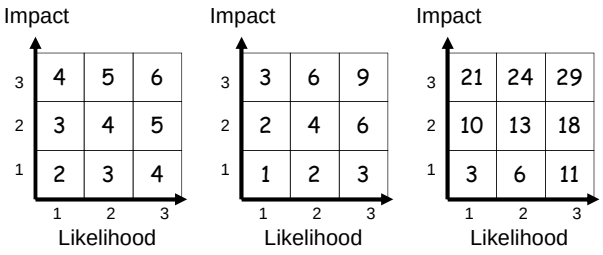
## Examples




RN = I+L

RN = I*L

RN = $(\alpha*I)^2 + (L)^2$
$\alpha = 1.5$

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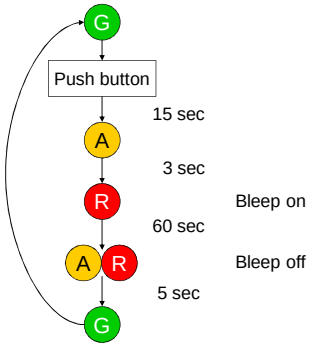
## EXERCISE: traffic light system

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## EXERCISE: traffic light system

- Features
  - Push button
  - Get time
  - Green on
  - Green off
  - Amber on
  - Amber off
  - Red on
  - Red off
  - Bleep on
  - Bleep off

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## EXERCISE: traffic light system

| | Feature | Likelihood of failure (1-10) | Impact of failure (1-10) | Risk number |
|---|---|---|---|---|
| F1 | Push button | | | |
| F2 | Get time | | | |
| F3 | Green on | | | |
| F4 | Green off | | | |
| F5 | Amber on | | | |
| F6 | Amber off | | | |
| F7 | Red on | | | |
| F8 | Red off | | | |
| F9 | Bleep on | | | |
| F10 | Bleep off | | | |

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## Risk analysis: WHO?

- A broad team
  - Users
  - Developers
  - Testers
  - Support personnel
  - Marketing team
  - Application domain experts

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## Risk analysis: HOW?

- Brainstorming sessions
- Based on all available sources of information
  - Requirement specification
  - Functional specification
  - Defect reports
  - User experience
  - Developer / Tester experience
  - . . .
- First collect ideas – no debating

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## Risk analysis: HOW?

- Examples of things that can go wrong
  - "Real world" effects
  - Computer problems
  - Incorrect input
  - Failure to meet user expectations
  - . . .

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## Risk analysis based on Requirement Specification

- Assumptions
- Domain knowledge - need continuous verification v. customer
- Risk factors – how complex is this requirement? How mature is technology? Does the team has capability?
- Priority / release date – when is this requirement needed?
- Work planning – what work is needed to test this requirement?
- Benefits – what business benefit does this requirement contribute to?
- Satisfaction / dissatisfaction factor – how happy / unhappy will the customer be if this requirement is met / not met

From "A Primer on Requirements Engineering", Beaver Consulting

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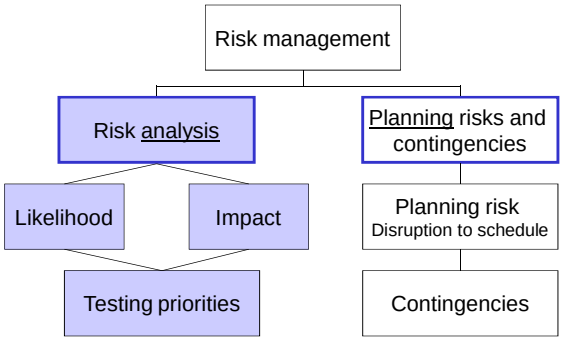
## Risk management

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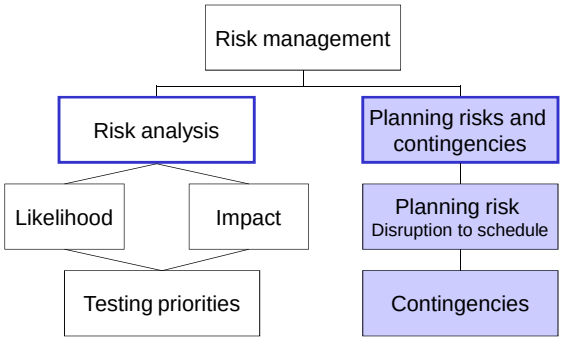
## Risk management

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## Planning risks and contingencies

"Murphy's Law is alive and well"

- Planning risk examples
  - Late requirements
  - Late delivery of software
  - Computer environment problems
  - …
- Use "What if …" analysis to develop contingencies

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## Planning risks and contingencies

- For the high impact components a full contingency plan is necessary
- Examples of contingencies
  - Reduce the scope of the project
  - Delay implementation
  - Add resources
  - Reduce quality process
  - . . .

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| RISK | HOW? | TESTS NEEDED | CONTINGENCY PLAN |
|---|---|---|---|
| No access | - System down<br>- Database unavailable | ST12.34 – 12.75<br>ST45.12, ST31.1 | Mirror system |
| Wrong value | - Old value used<br>- conversion factor not applied | ST12.34<br>ST45.12 | Allow manual entry of value |

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## Homework

In the "IEEE Standard 829-1998 for Software Test Documentation"
http://www.cs.bham.ac.uk/~exc/Teaching/STesting/Web_resources.html

- Identify item "Risk and contingencies" in the outline test plan (4.2)
- Study an example of the Risk and contingencies plan (p. 26).

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## Further reading

- Craig and Jaskiel "Systematic Software Testing", Chapter 2: "Risk analysis"
- "A Primer on Requirements Engineering", Beaver Consulting
  http://www.cs.bham.ac.uk/~exc/Teaching/STesting/Requirement_Primer.pdf

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## Next lecture

Practical example in test case design

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