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Instructions

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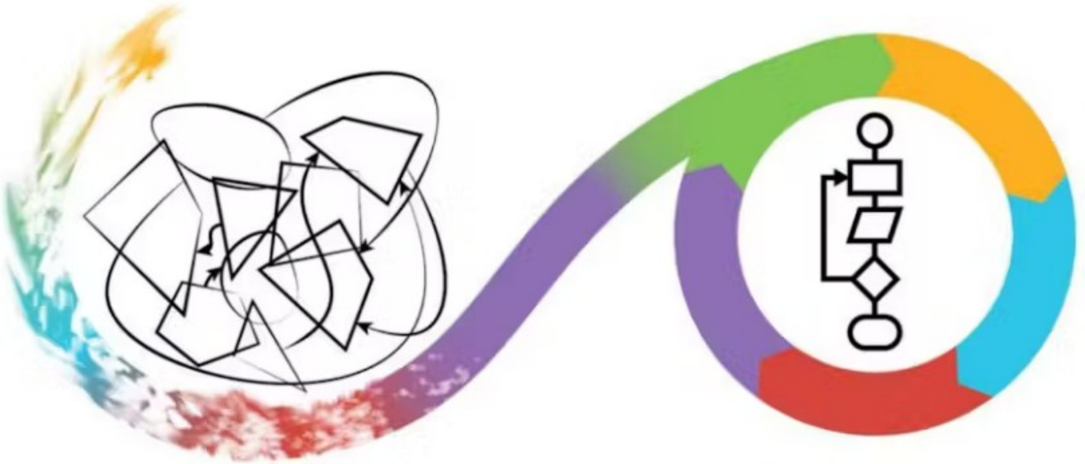
Todays topics

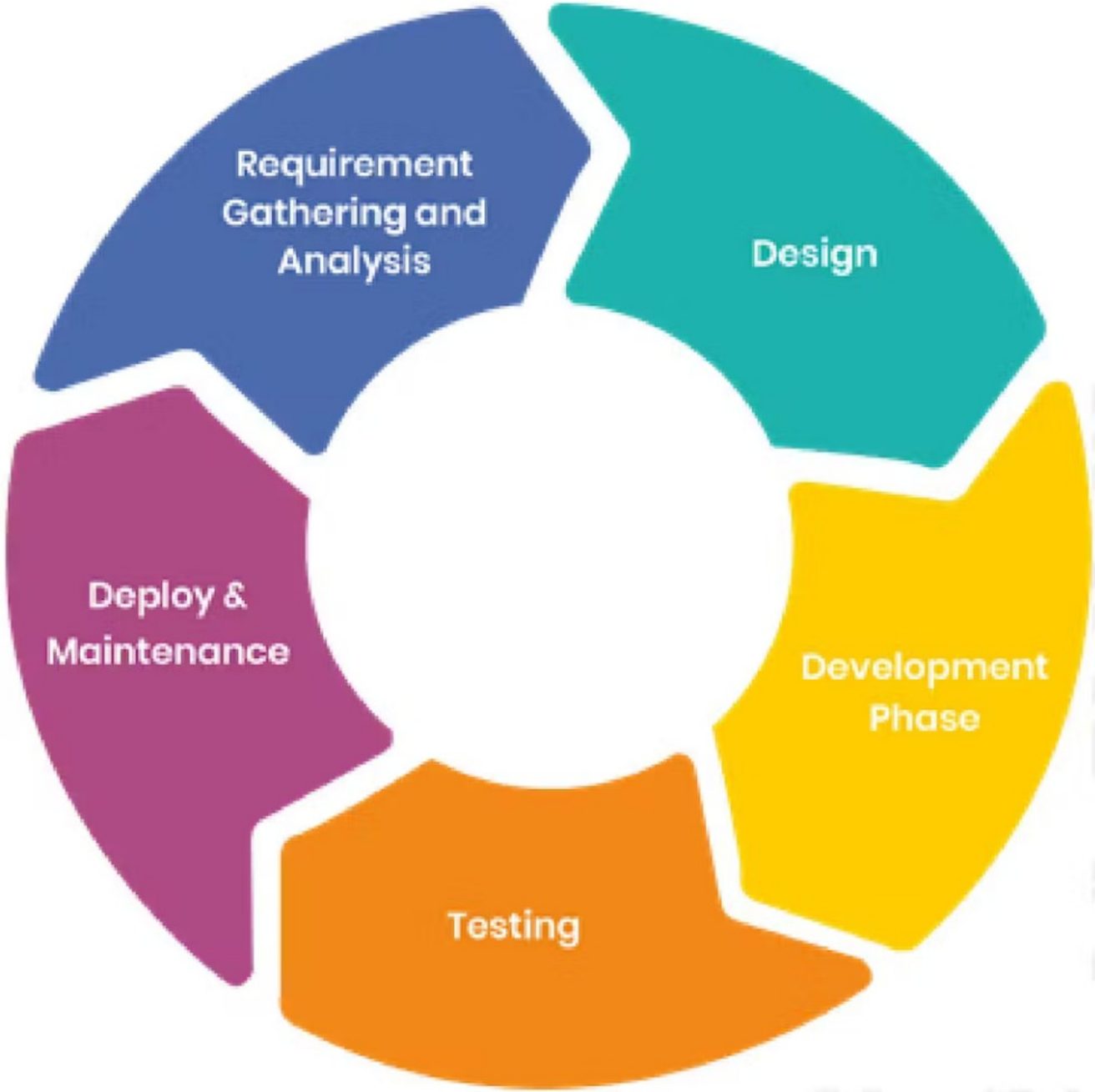
- Software Development Life Cycle (SDLC)
- Requirements analysis
- AI assisted development
- Student Project - Analysis of brief - excersie
- Common development models
- Risk assesment
- UML
- Use Case Diagrams
- Student Project Use case model
- Activity diagram
- Student Project Activity diagram

Design and Development

Paradigms and common models

Utilising The formal process of Development
Turns our software process form a unformed chaos with low chance of success into a well ordered shareable software solution.





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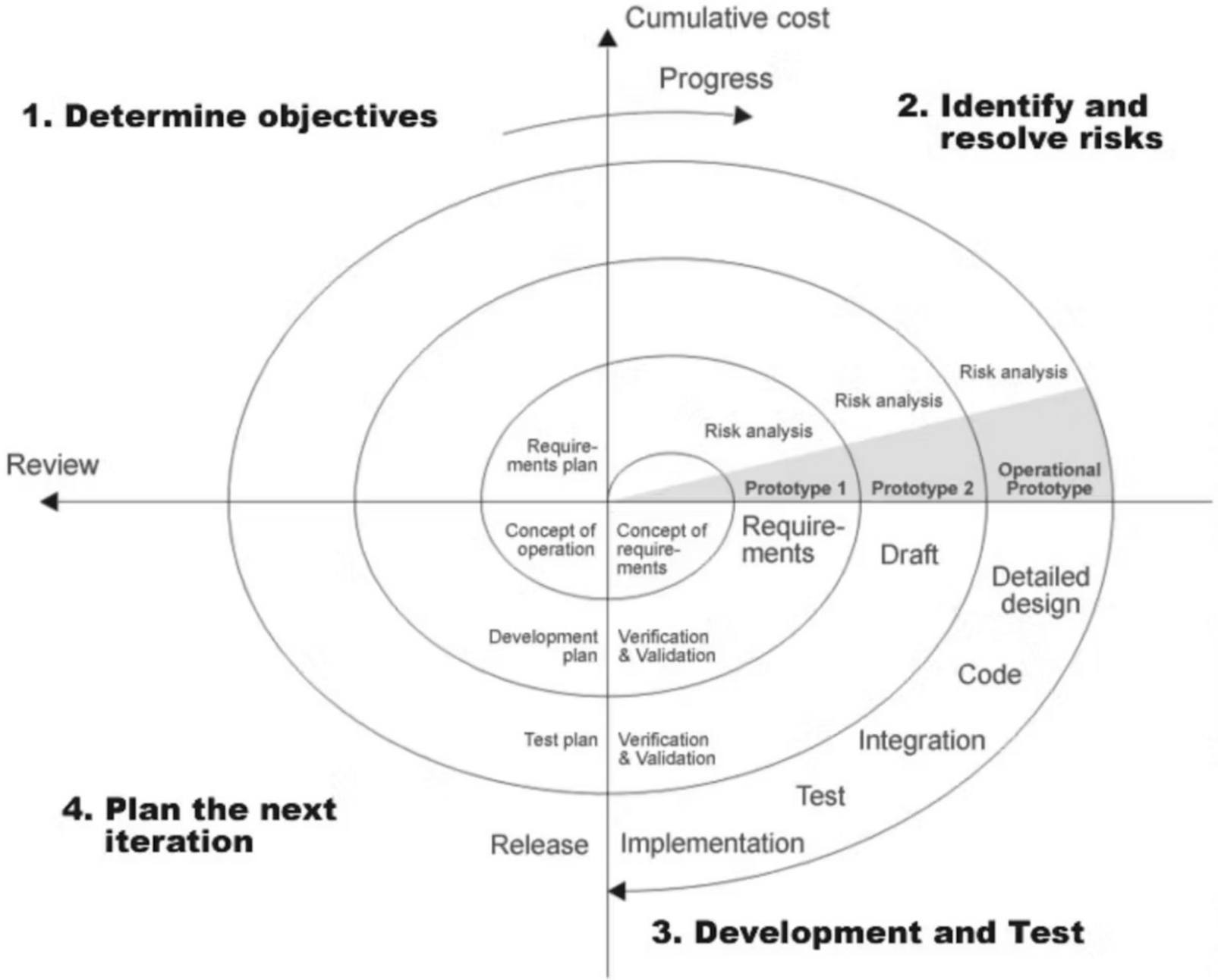
Cumulative cost
Progress
1. Determine objectives
2. Identify and resolve risks
Review
Risk analysis
Risk analysis
Risk analysis
Require-ments plan
Prototype 1
Prototype 2
Operational Prototype
Concept of operation
Concept of require-ments
Require-ments
Draft
Detailed design
Development plan
Verification & Validation
Code
Test plan
Verification & Validation
Integration
Test
4. Plan the next iteration
Release
Implementation
3. Development and Test

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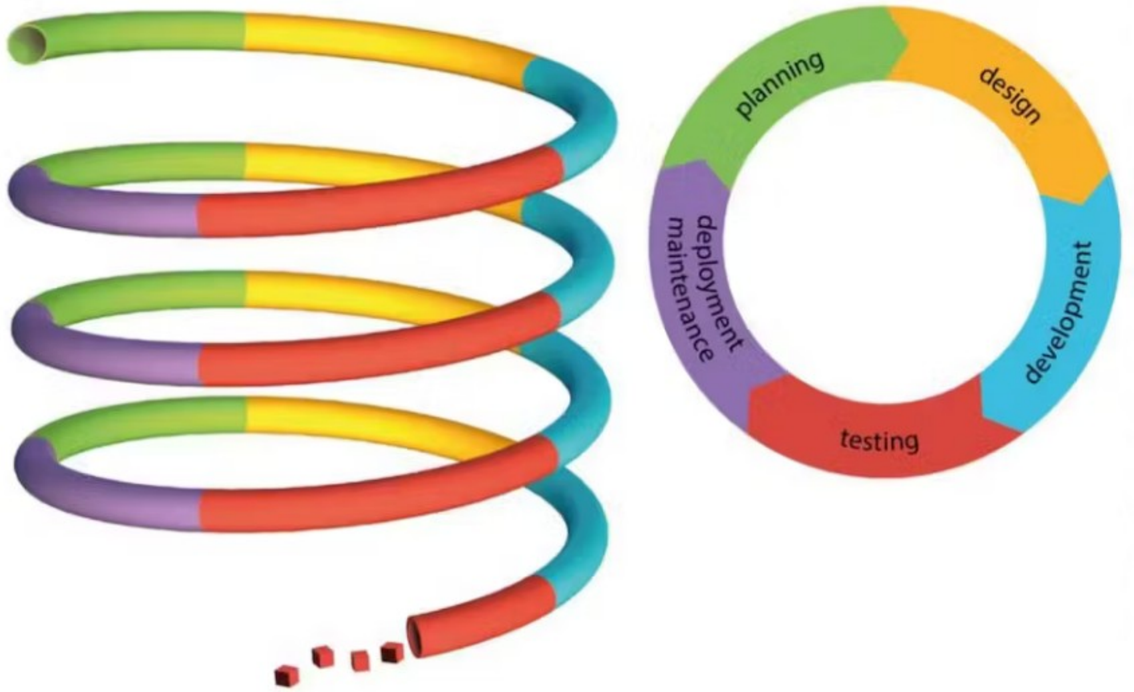
SDLC

Iterations build software over time until the cost of the next phase exceeds the cost we are willing to pay.



AI assisted development

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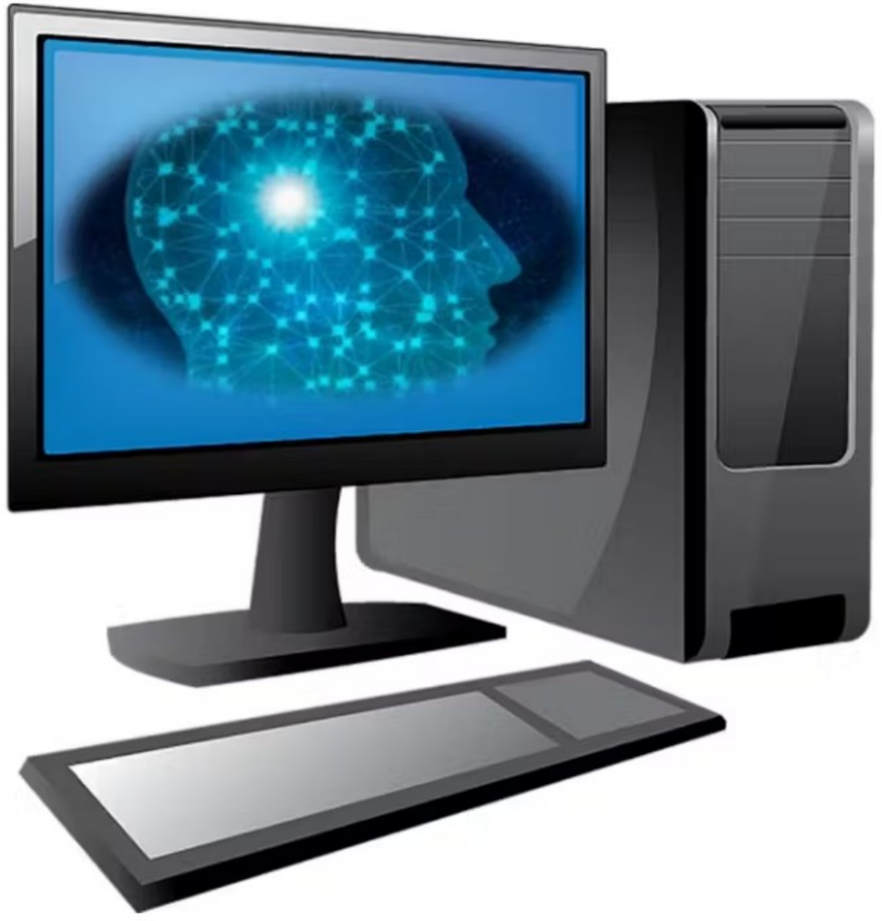

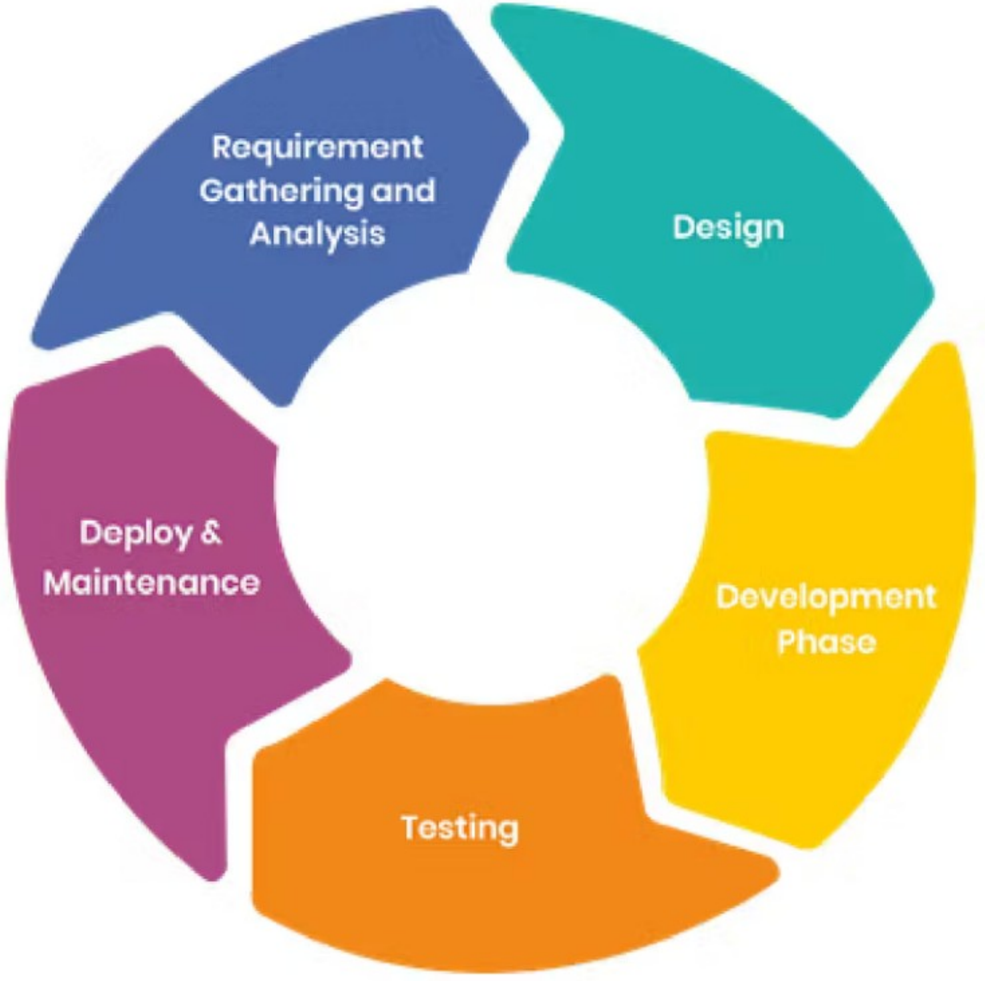

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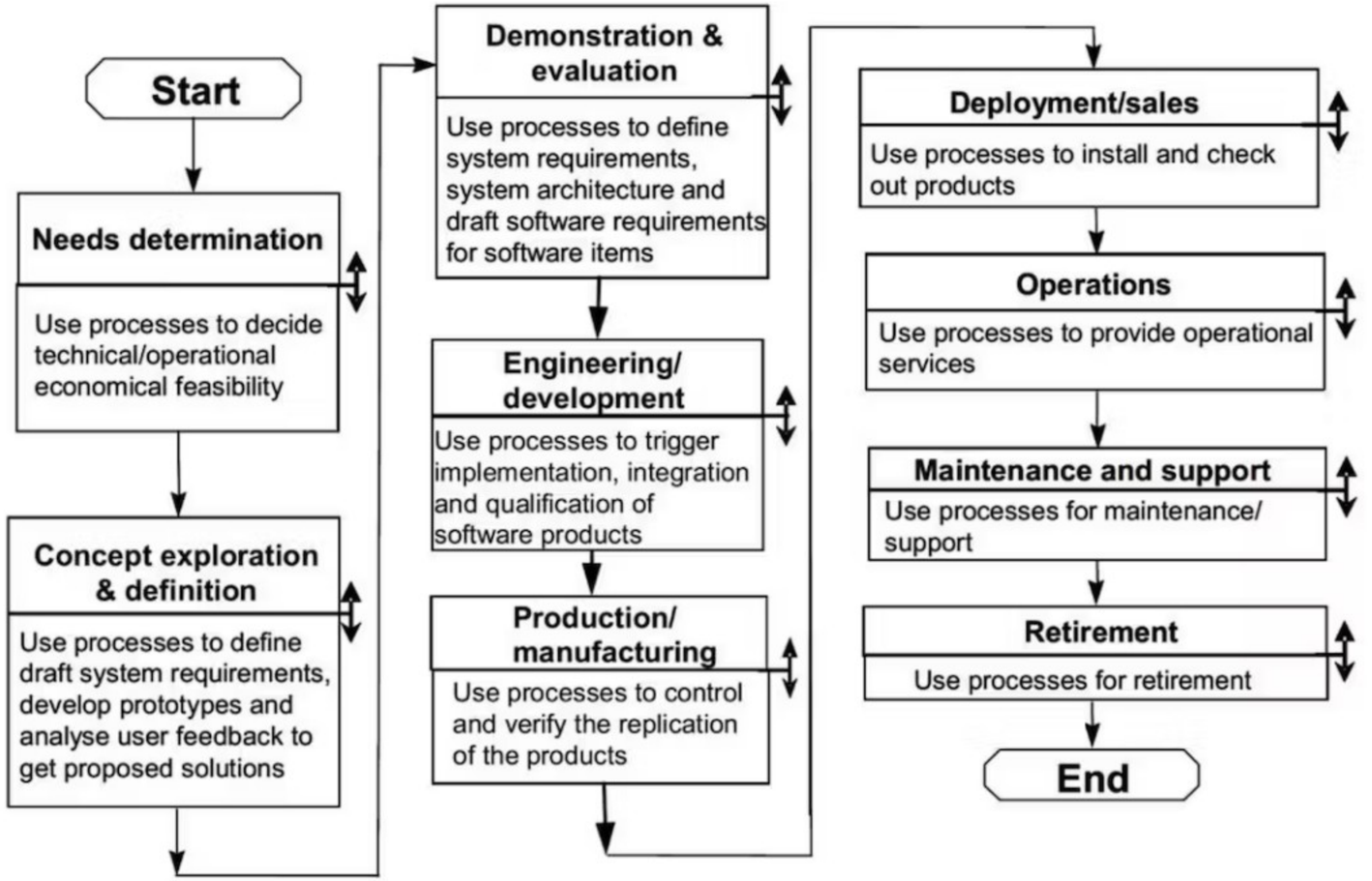
What is AI assisted Development

- Using Genreative AI like CHATGPT or GitHUB copilot throughut your development process
- NOT the computer has the answers
- Faster development through generating parts of your design or code using generative AI


Start
Needs determination
Use processes to decide technical/operational economical feasibility
Concept exploration & definition
Use processes to define draft system requirements, develop prototypes and analyse user feedback to get proposed solutions
Demonstration & evaluation
Use processes to define system requirements, system architecture and draft software requirements for software items
Engineering/ development
Use processes to trigger implementation, integration and qualification of software products
Production/ manufacturing
Use processes to control and verify the replication of the products
Deployment/sales
Use processes to install and check out products
Operations
Use processes to provide operational services
Maintenance and support
Use processes for maintenance/ support
Retirement
Use processes for retirement
End

Requirements analysis

- Mark all verb -> Actions for your system
- Subjects -> Properties of your system
- Objects -> Targets of your system
- Find Non functional requirments
- Find technical Requirments(sub set of previous)
- Find non expressed (derived requirements)

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TOOLS for AI assisted development

- ChatGPT https://chat.openai.com/
- GitHub co-pilot https://github.com/features/copilot
- CodiumAI https://www.codium.ai/
- https://www.codium.ai/blog/10-best-ai-coding-assistant-tools-in-2023/

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What are common needs for scientific software

Waiting for responses ...

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Student Project

To start of the Student project you are going to be the Requirement Analysis team Your Job is to take the Project breif and analyse it for Requirments. You can use or not use AI-Assistance or both in order to find atleast 10 requirments for your software.
https://github.com/programming-formalisms/programming_formalisms_project_autumn_2023

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Student Project Brief

To simulate bacterial movement in 2D space.

One way to model bacterial movement is the run and tumble model, where 'run' is going straight in a direction, and 'tumble' is picking a random direction. The 'run' lasts longer when a bacterium finds more and more nutrients (e.g. dissolved sugars), and lasts shorter when finding less and less nutrients.

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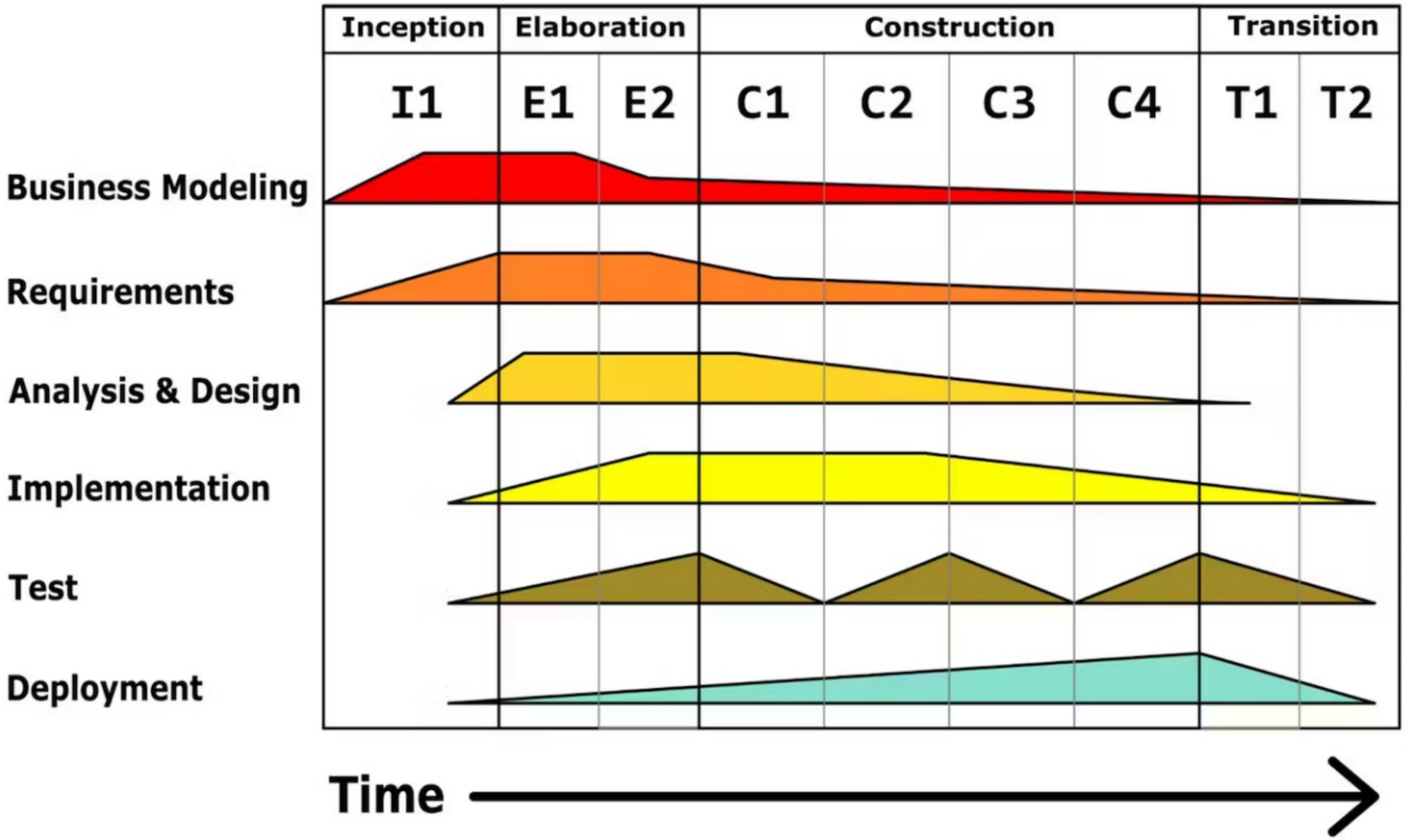
Iterative Development

Business value is delivered incrementally in time-boxed crossdiscipline iterations.



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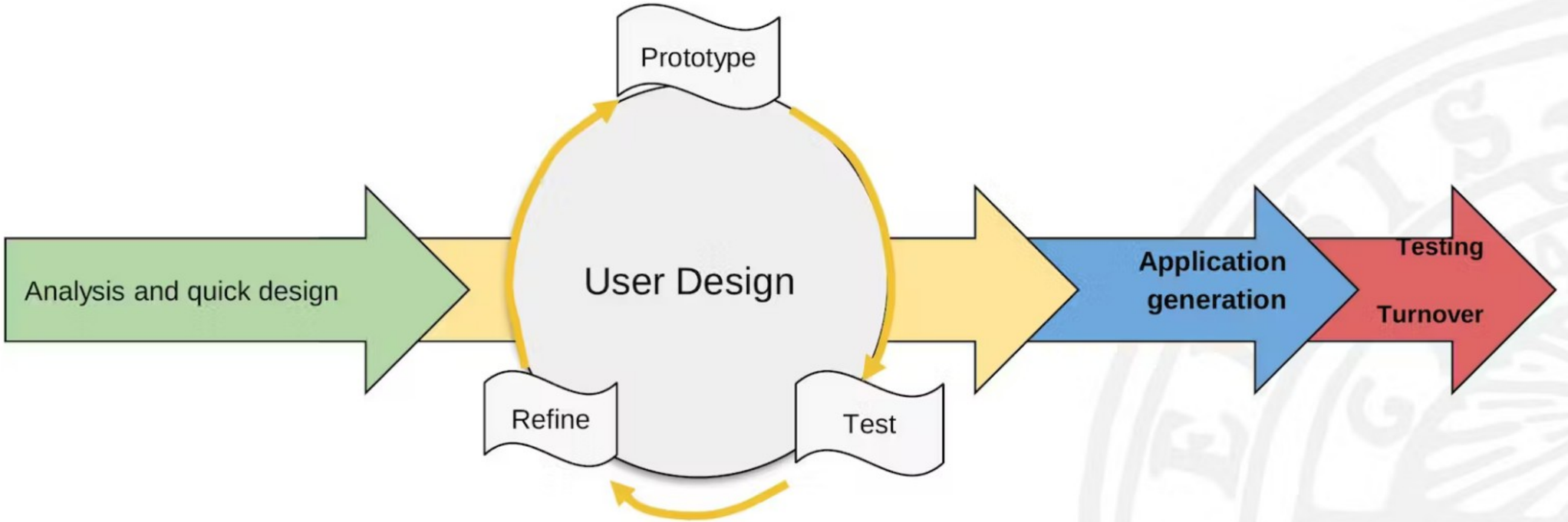
Rapid Application Development process



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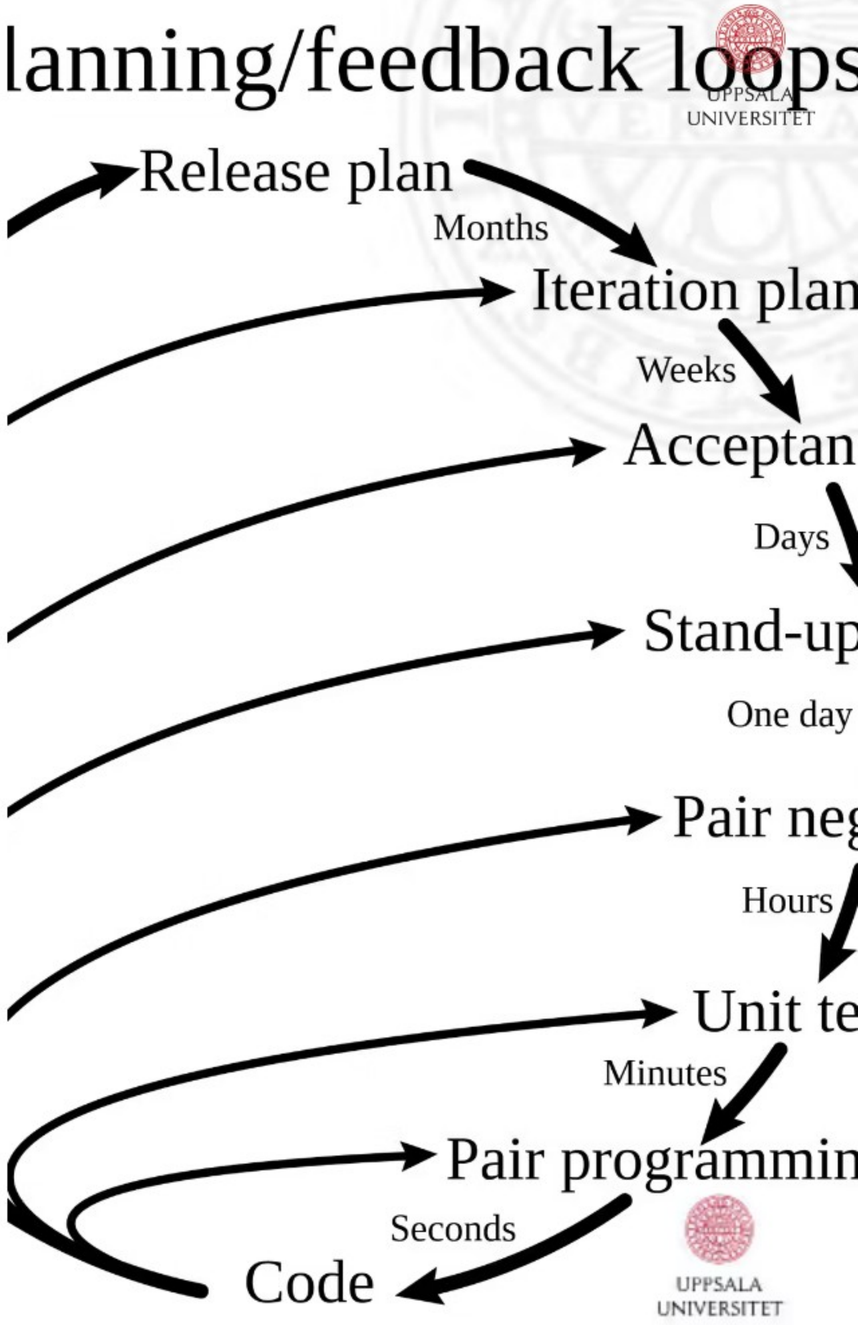
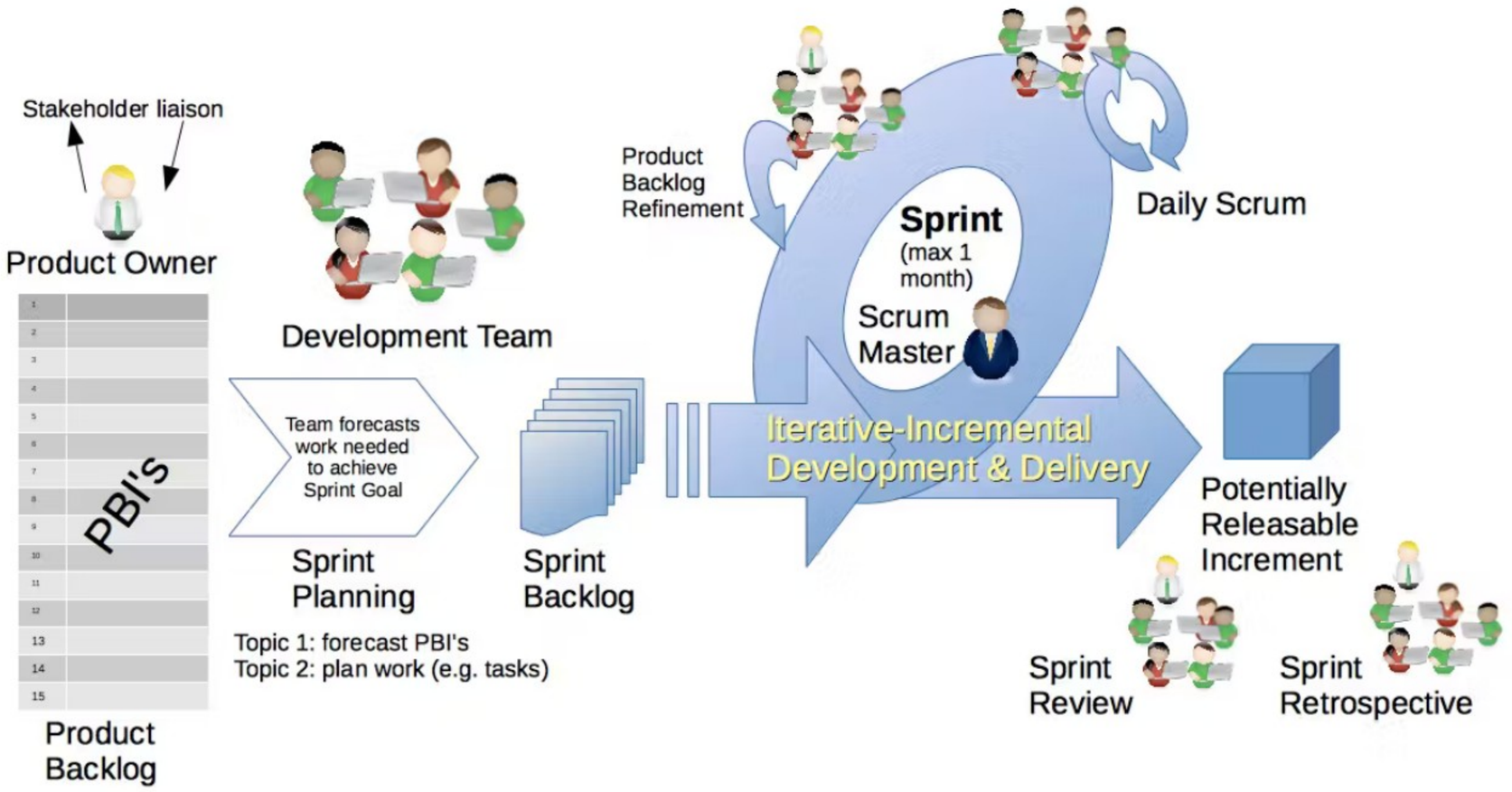
eXtreme Programming(XP)

- Key Practice #1 – Pair Programming
- Key Practice #2 – Planning Game,precursor to what many of us know as “Sprint Planning”
- Key Practice #3 – Continuous Process
- Key Practice #4 – Coding Standards
- Key Practice #5 – Sustainable Pace
- Key Practice #6 – Test Driven Development (TDD)





The Scrum process,
https://upload.wikimedia.org/wikipedia/commons/d/df/Scrum_Framework.png

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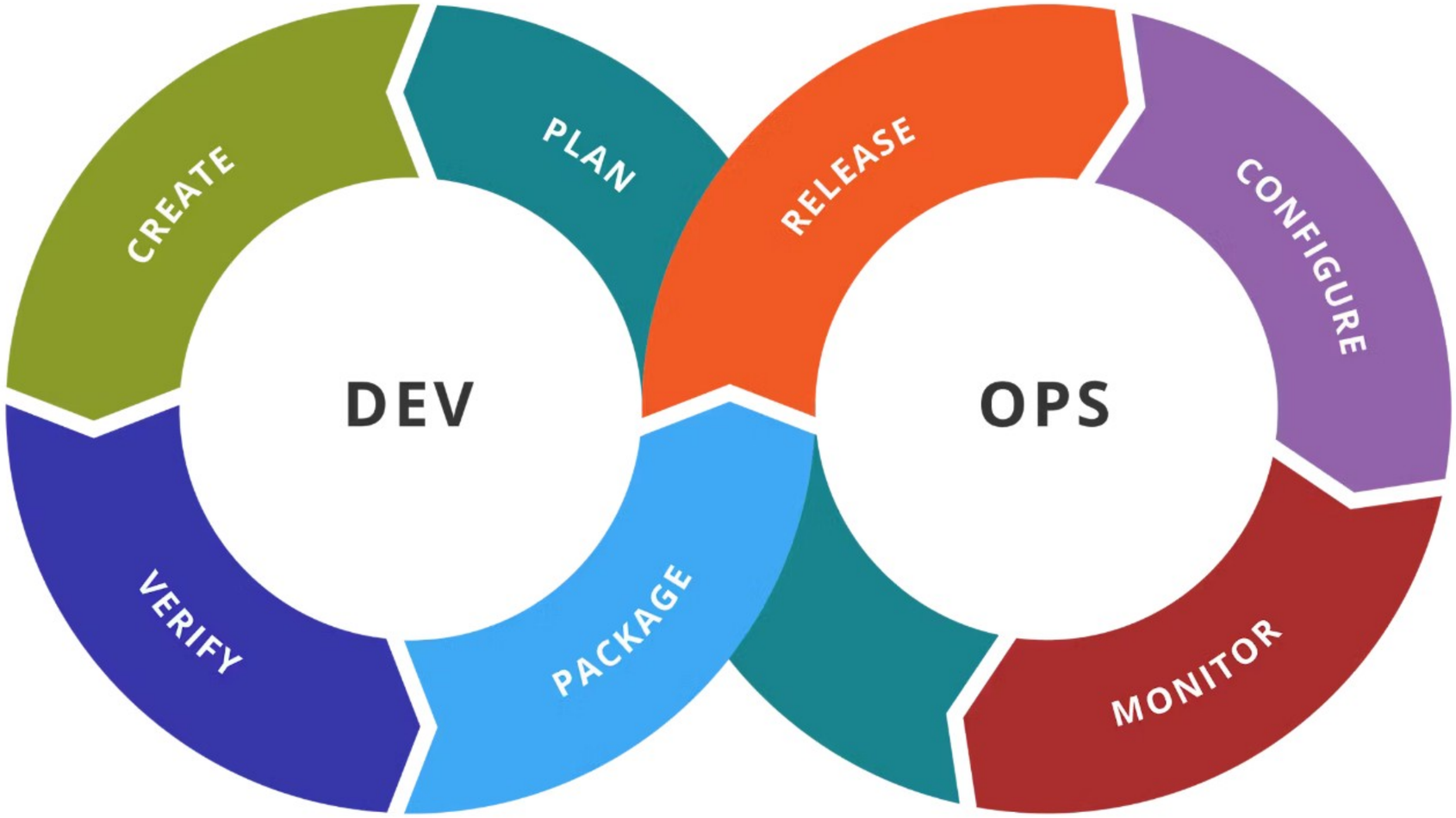

DevOps combines development and operations

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Principles behind the Agile Manifesto

Our highest priority is to satisfy the customer
through early and continuous delivery
of valuable software.

Welcome changing requirements, even late in
development. Agile processes harness change for
the customer's competitive advantage.

Deliver working software frequently, from a
couple of weeks to a couple of months, with a
preference to the shorter timescale.

Business people and developers must work
together daily throughout the project.

Build projects around motivated individuals.
Give them the environment and support they need,
and trust them to get the job done.

We are uncovering better ways of developing
software by doing it and helping others do it.
Through this work we have come to value:

Individuals and interactions over processes and tools
Working software over comprehensive documentation
Customer collaboration over contract negotiation
Responding to change over following a plan

That is, while there is value in the items on
the right, we value the items on the left more.

Kent Beck , James Grenning , Robert C. Martin
Mike Beedle, Jim Highsmith, Steve Mellor
Arie van Bennekum, Andrew Hunt, Ken Schwaber
Alistair Cockburn, Ron Jeffries , Jeff Sutherland
Ward Cunningham , Jon Kern, Dave Thomas
Martin Fowler, Brian Marick

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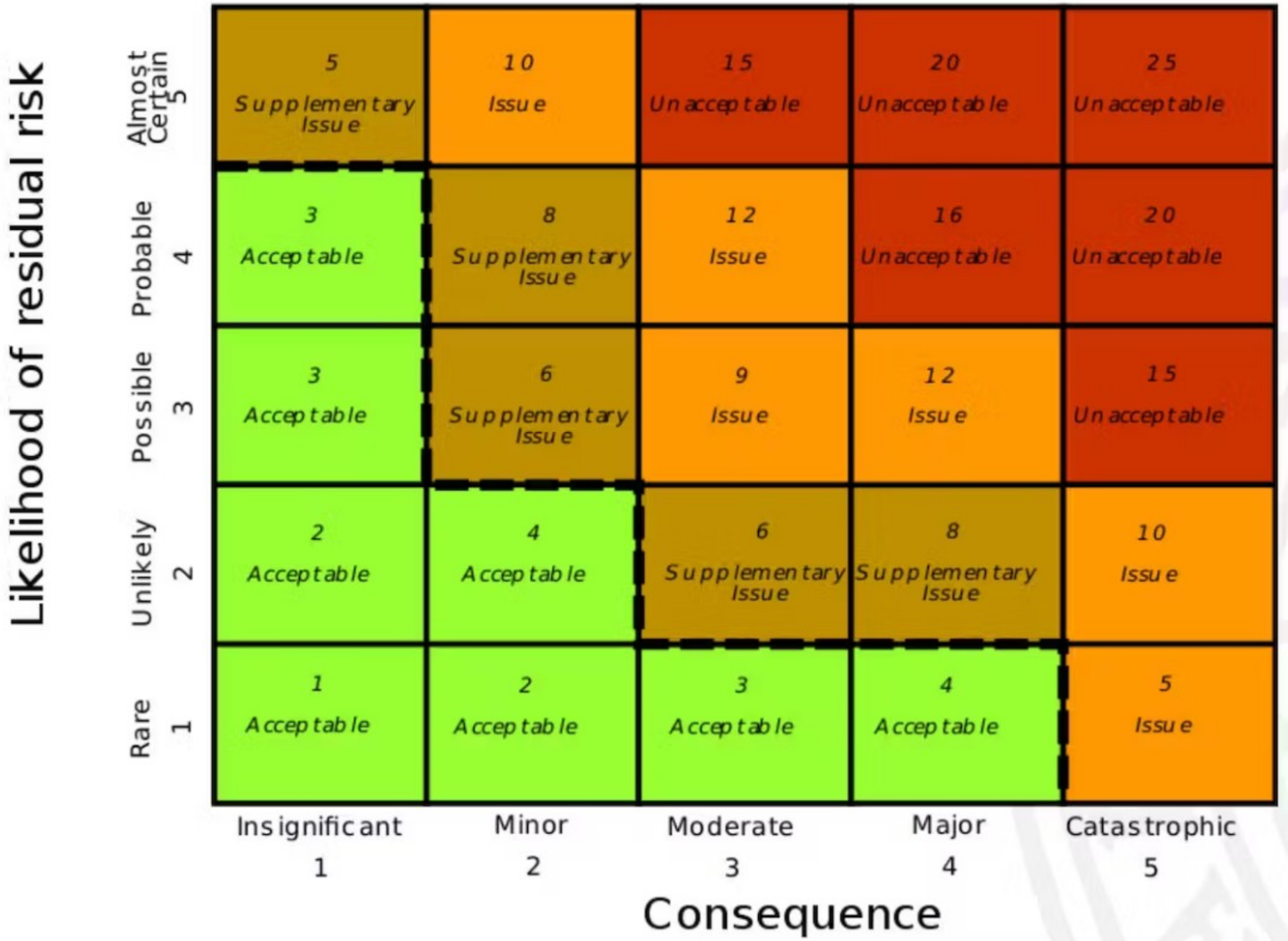
Risk analysis



Identify Risks

1. **Risk analysis scenarios**

   The risk **team** "brain storm" using mind maps, miro boards or whiteboard (post-it notes) potential application risks

1. **Risk Checklist**

   The risk **team** uses preprepared check lists of common risks and the team selects the risks that are applicable to their system

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Risks of Risk methods

1. Risk analysis scenarios

   Highly dependent on team experience and knowledge in order to identify pertinent scenarios

1. Risk Checklists

   Dependant of access to good curated lists, may result in missing risks if to stringent

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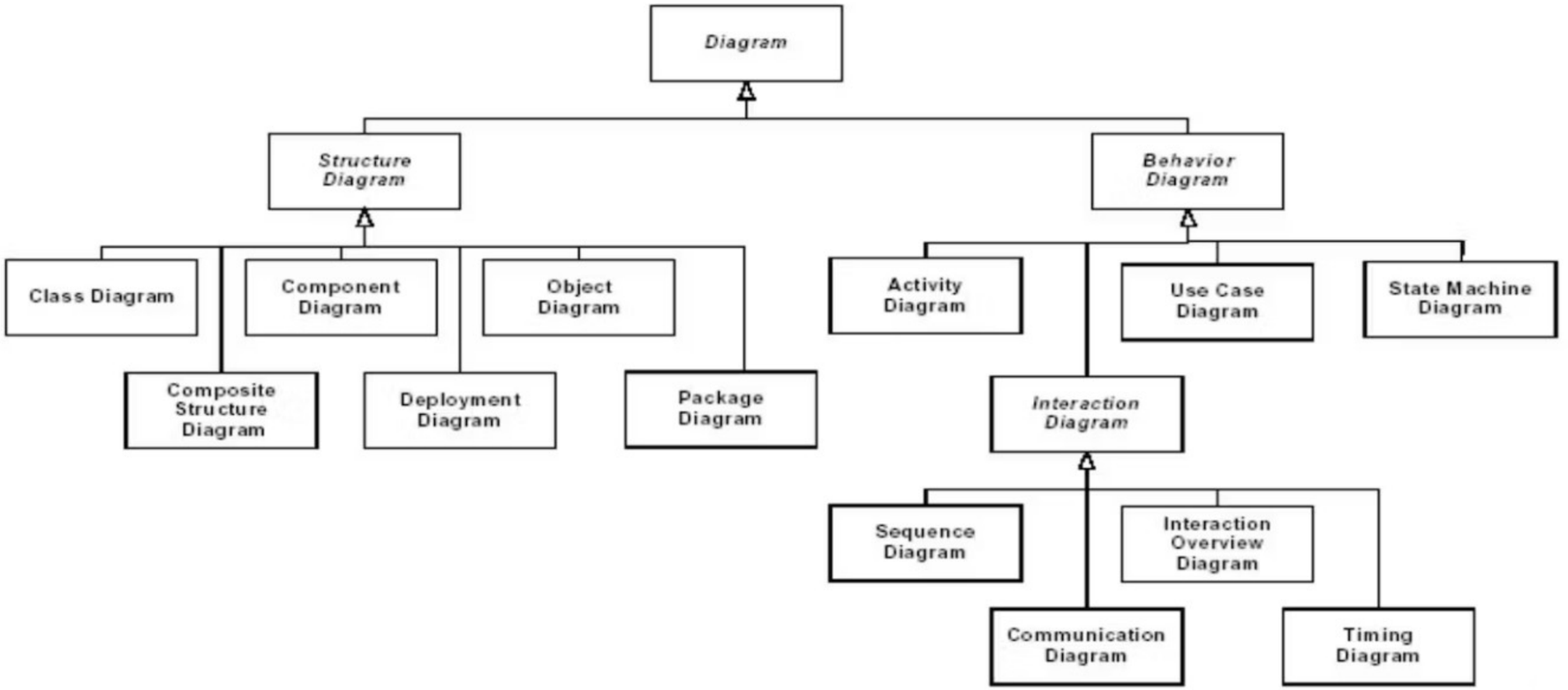
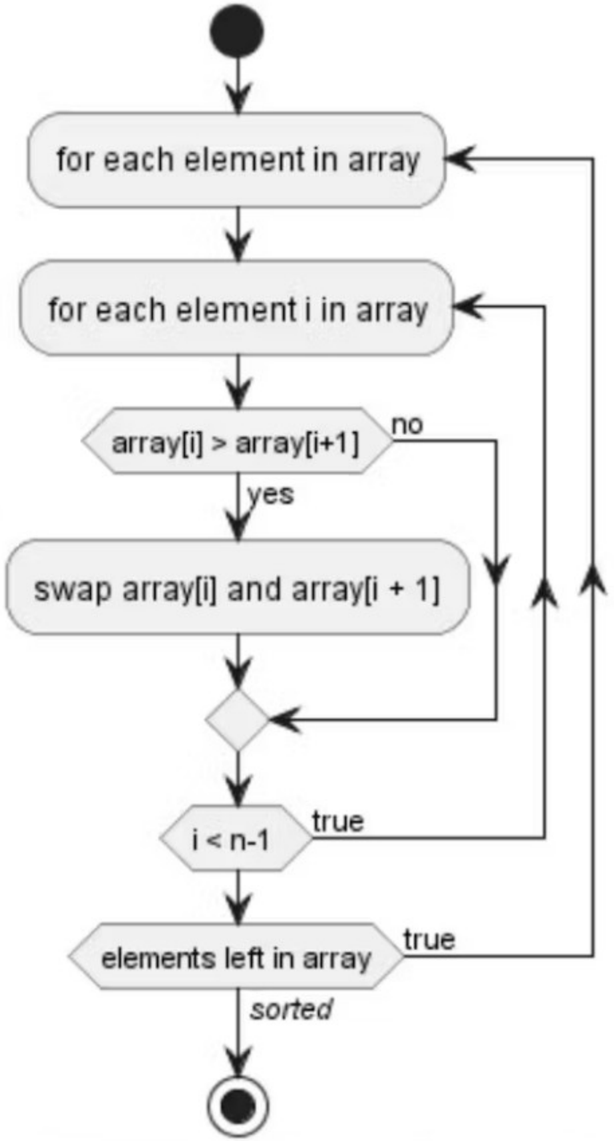
Typical Risk when devloping Scientific software

Waiting for responses ...

Schema of UML diagram types

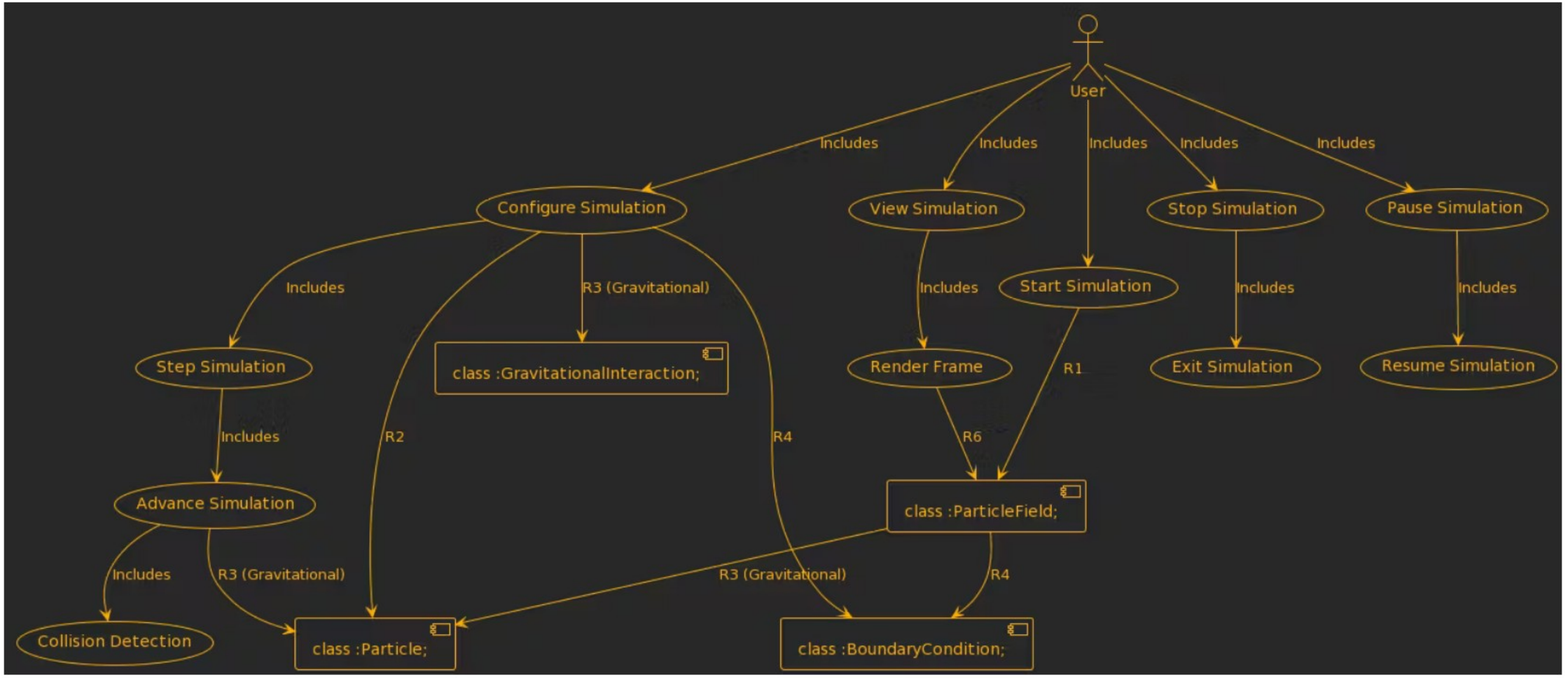


```plantuml
@startuml
!pragma useVerticalIf on
start
    repeat:for each element in array;
        repeat:for each element i in array;
            if (array[i] > array[i+1]) then (yes)
                :swap array[i] and array[i + 1];
            else (no)
            endif
    repeat while (i < n-1 ) is (true)
  repeat while (elements left in array) is (true) not
(//sorted//)
stop
@enduml
```



reference sheets

https://modeling-languages.com/best-uml-cheatsheets-and-reference-guides/



Use Case Diagram

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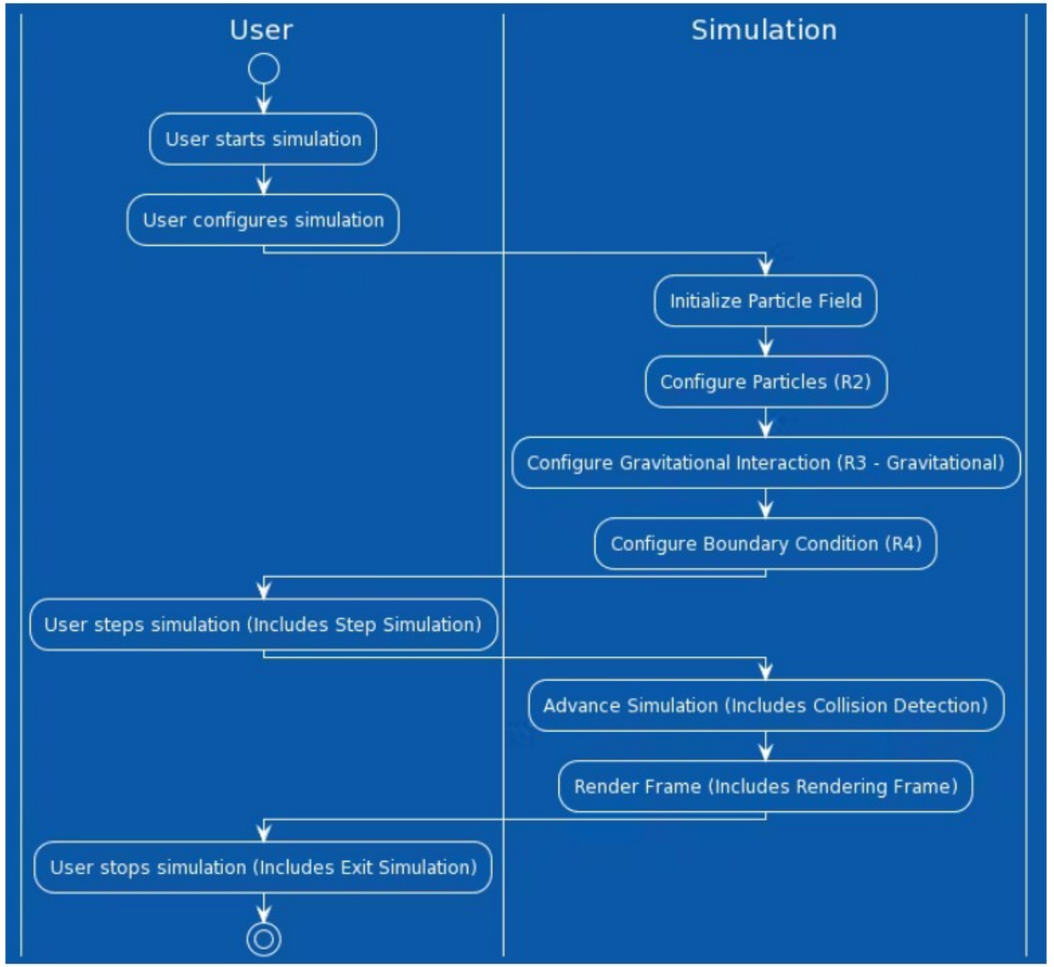
Student Project 2

Make a usecase model for the design of the Student project

Activity Diagram



Example project activity diagram start simulation

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Student Project 3

Design a sequence diagram for the flow of one or more of the intreaction in one or more of the usecases for the student project