Instructions

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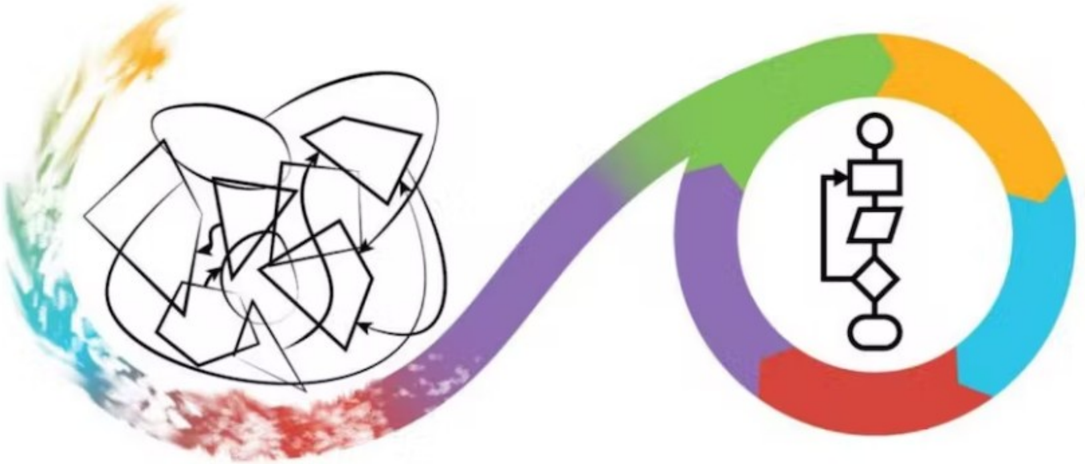
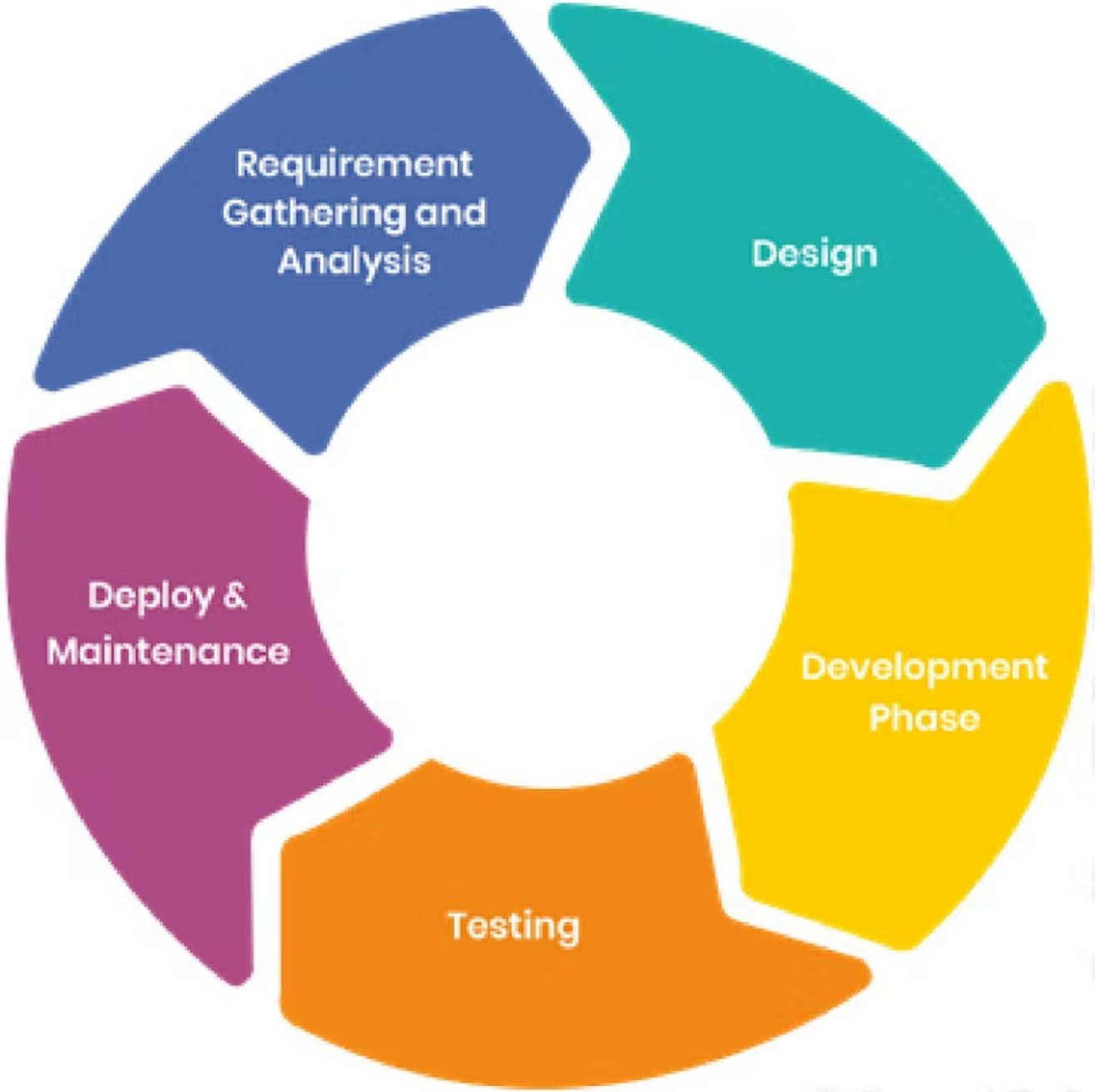
Design and Development

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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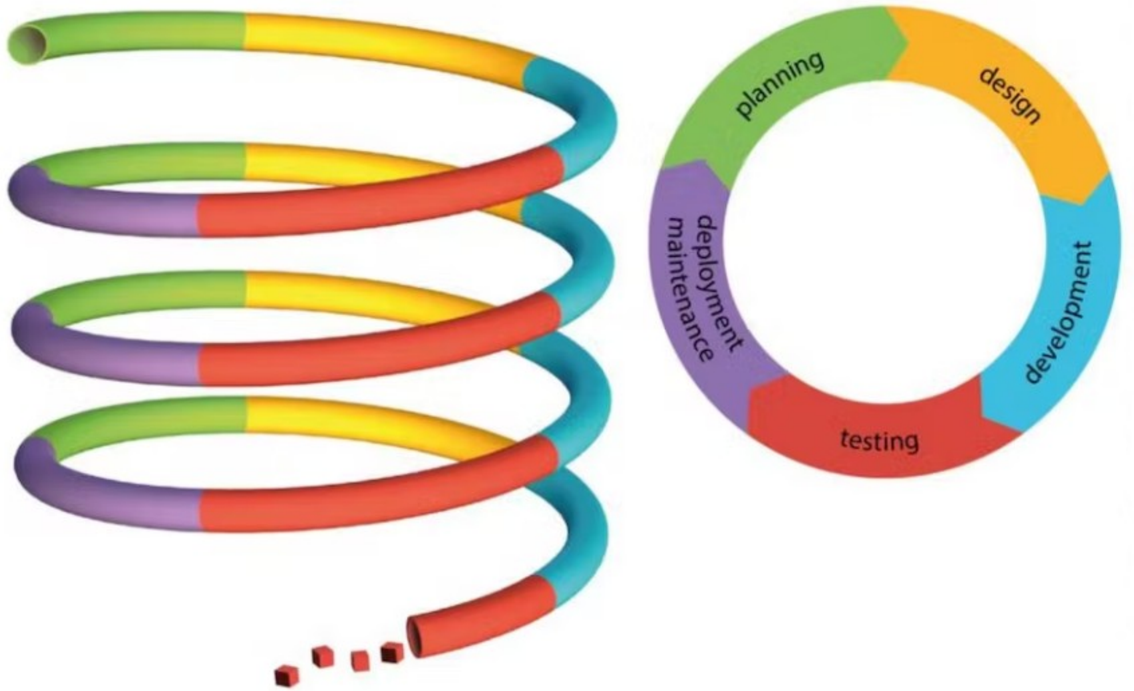
SDLC

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



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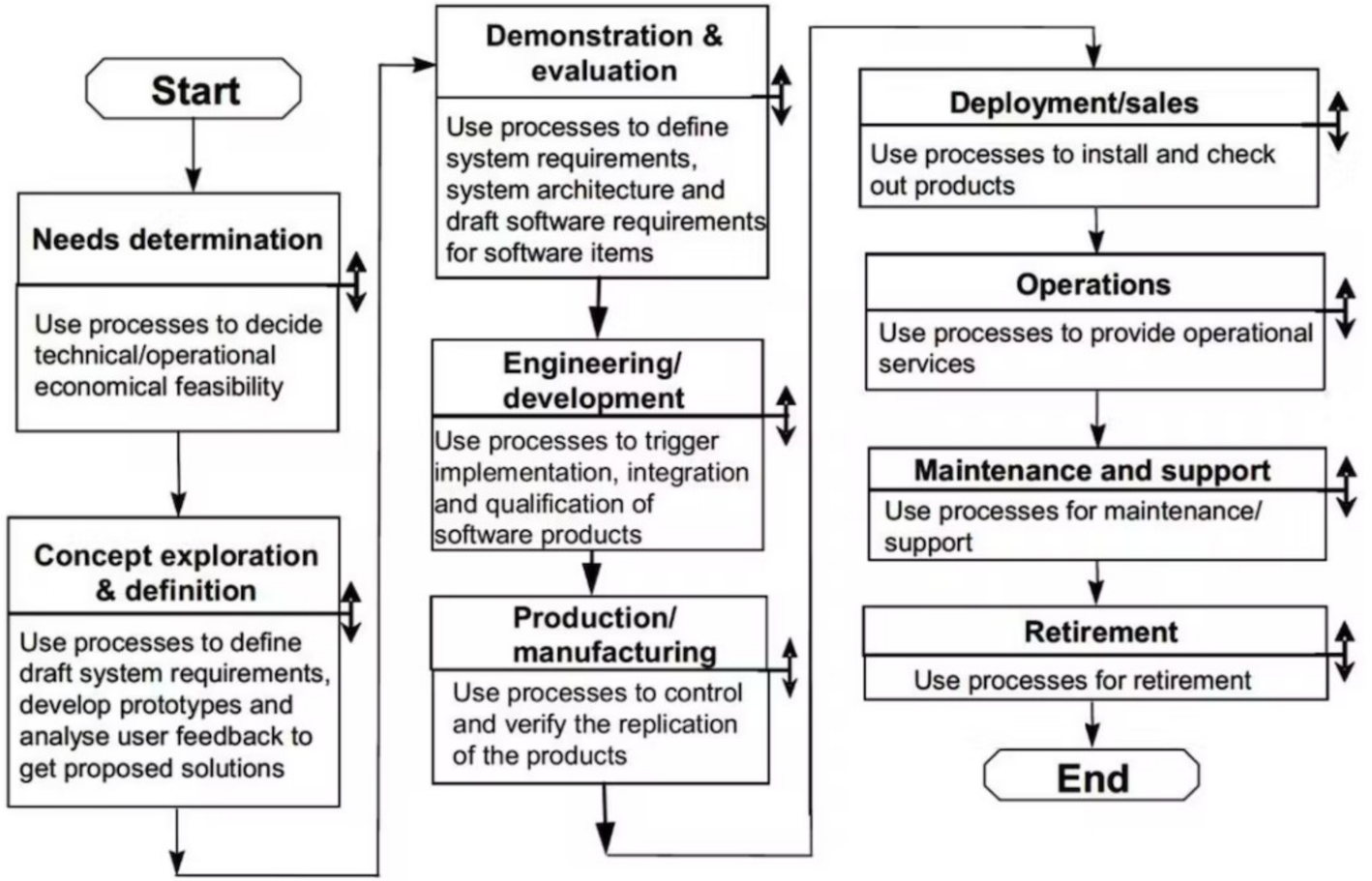
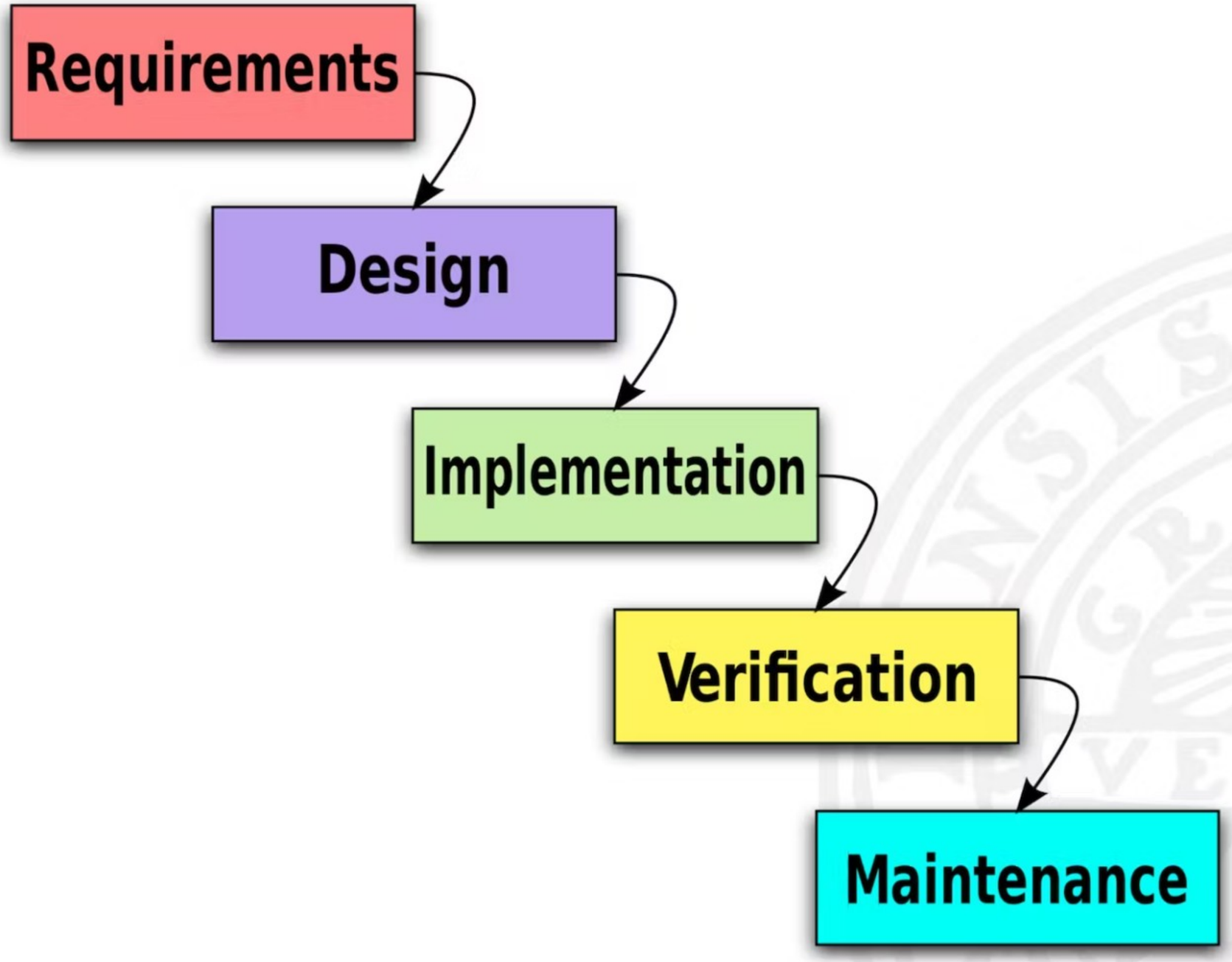

Start
Needs determination
Use processes to decide technical/operational economical feasibility
Concept exploration & definition
Use processes to define draft system requirements, develop prototypes and analyse user feedback to get proposed solutions
Demonstration & evaluation
Use processes to define 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

What are common needs for scientific software



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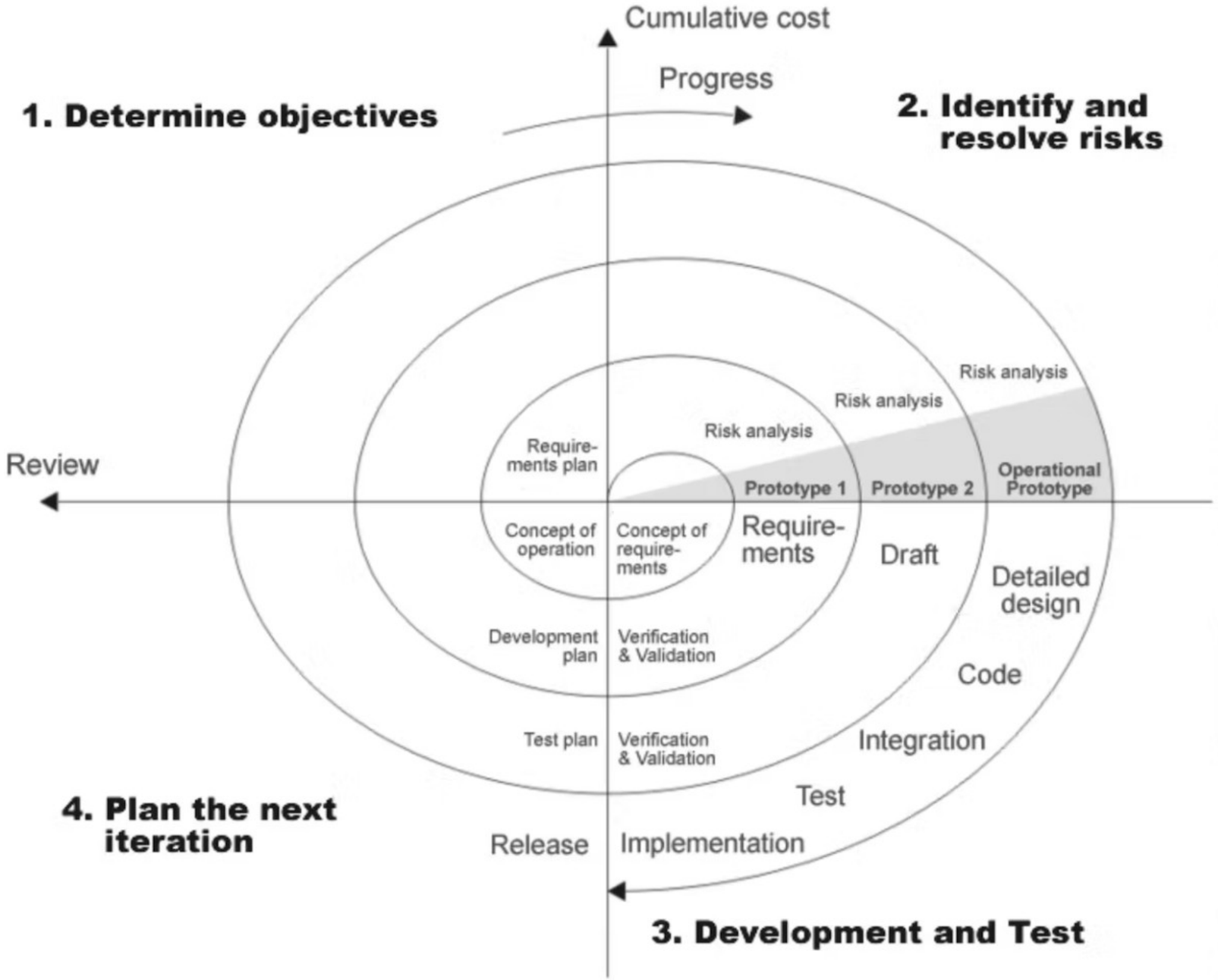
Cumulative cost
Progress
1. Determine objectives
2. Identify and resolve risks
Review
Risk analysis
Risk analysis
Risk analysis
Require-ments plan
Prototype 1
Prototype 2
Operational Prototype
Concept of operation
Concept of require-ments
Require-ments
Draft
Detailed design
Development plan
Verification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

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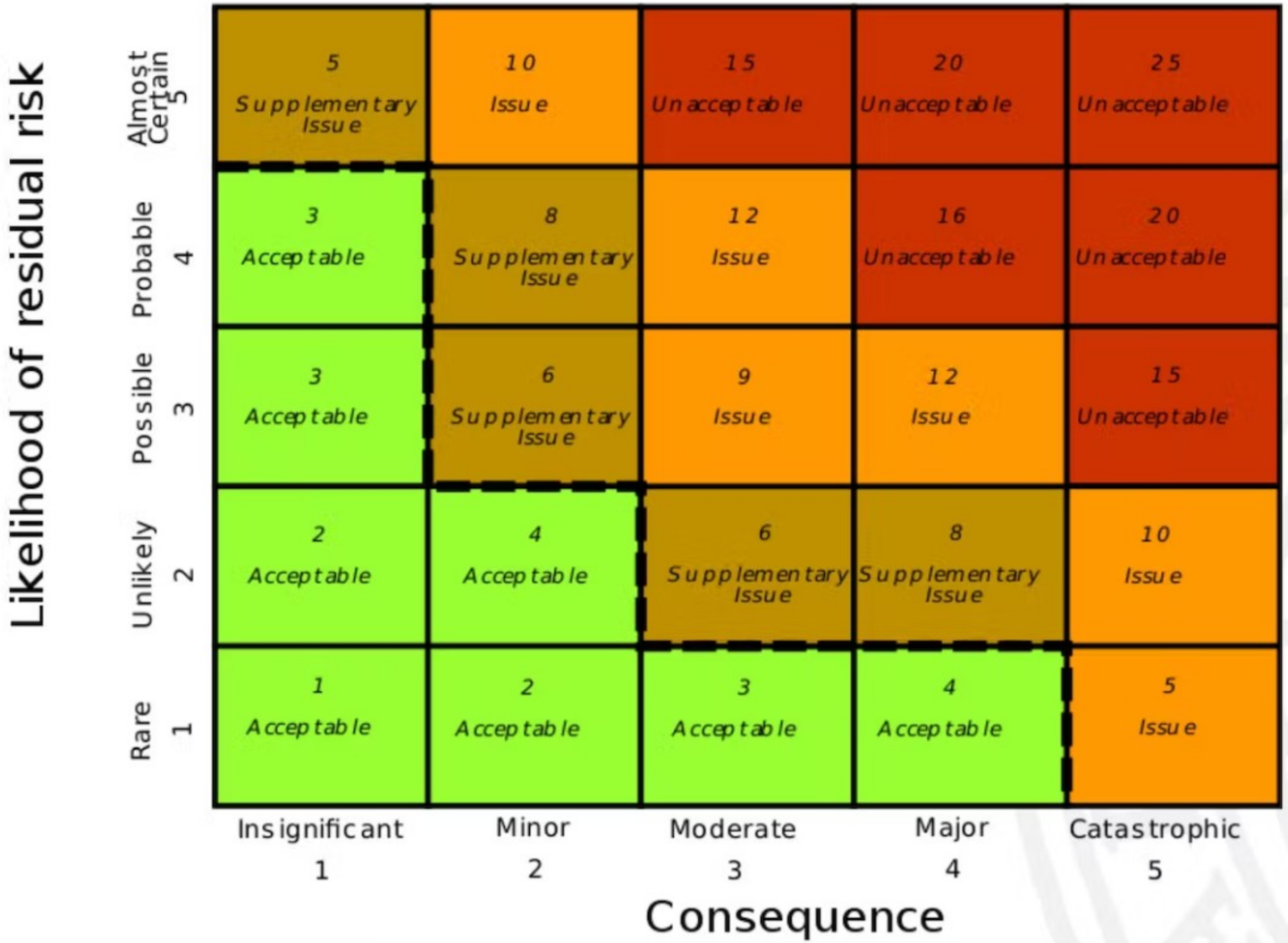
Risk analysis



Typical Risk when devloping Scientific software

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Exercise 1

Imagen that you are making a new scientific program like "blast" with a web interface Discuss Risks and Requirments (A short Needs Analysis)

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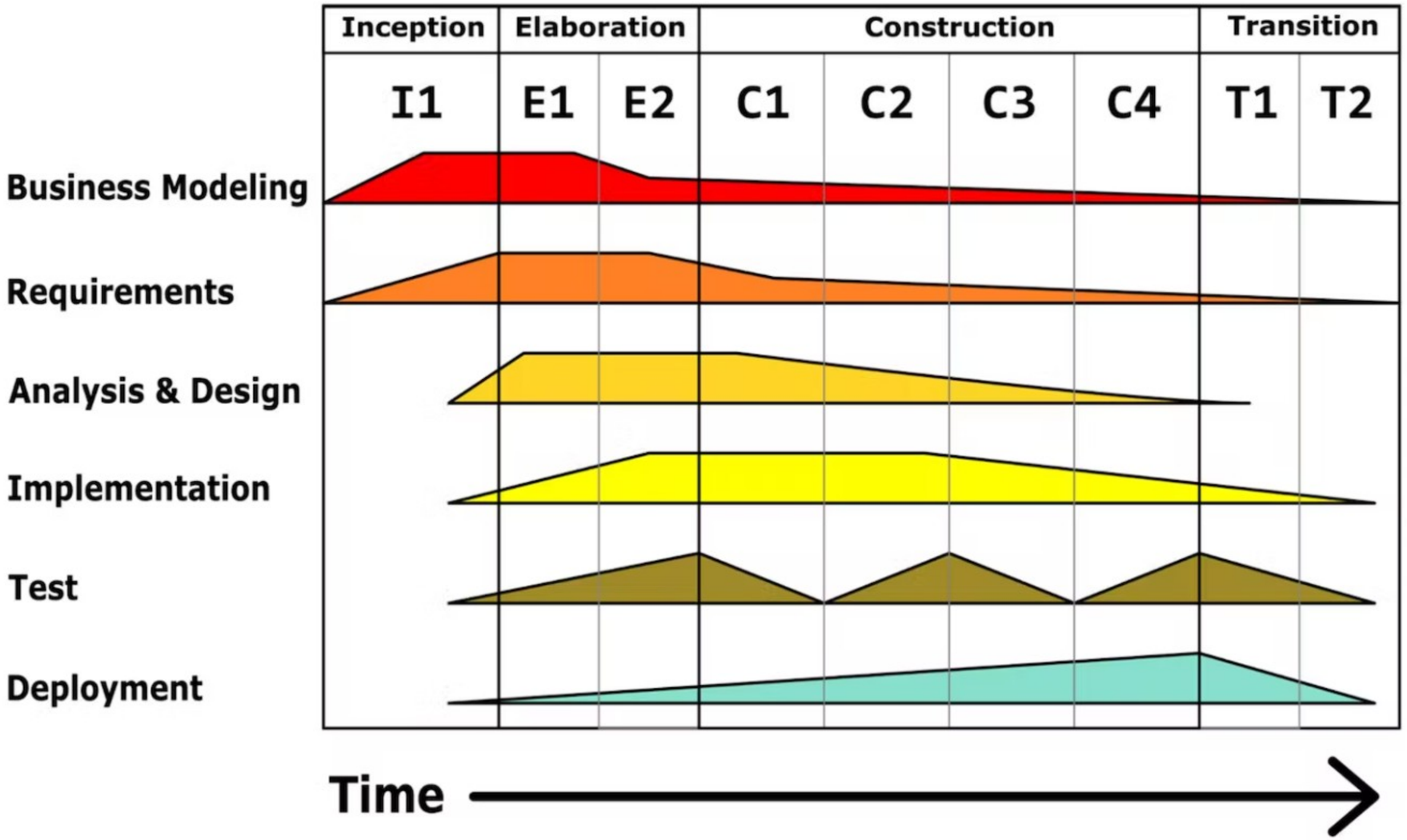
Iterative Development

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



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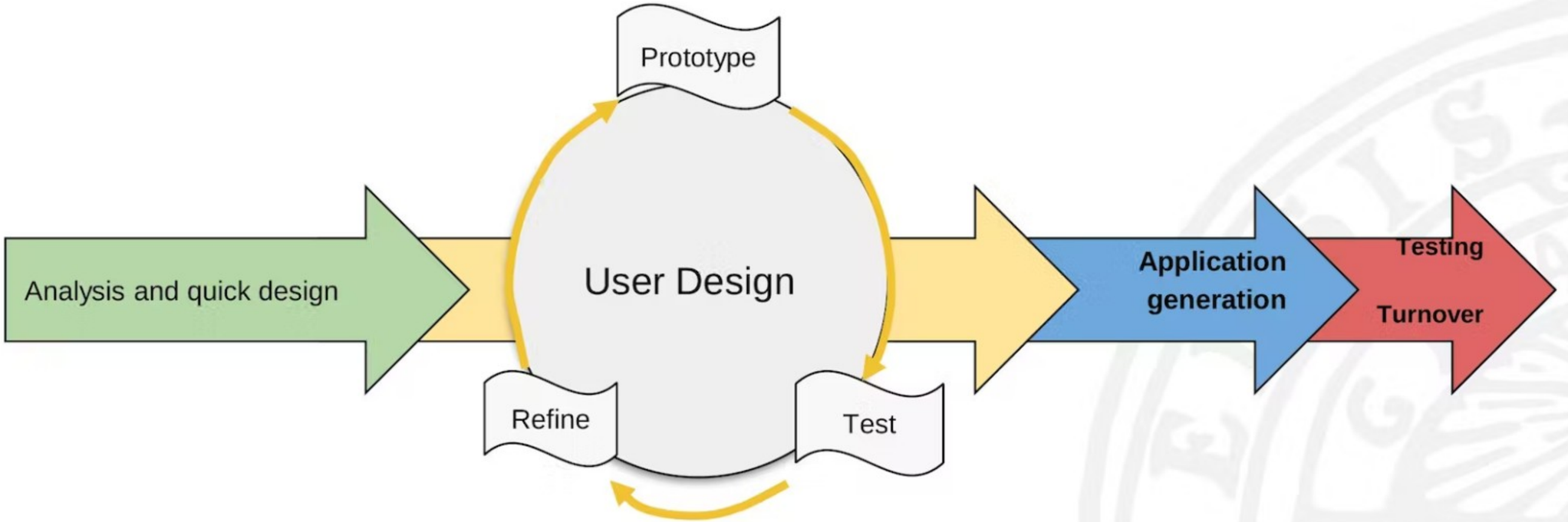
Rapid Application Development process



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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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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.

Principles behind the Agile Manifesto

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The most efficient and effective method of conveying information to and within a development team is face-to-face conversation.

Working software is the primary measure of progress.

Agile processes promote sustainable development. The sponsors, developers, and users should be able to maintain a constant pace indefinitely.

Continuous attention to technical excellence and good design enhances agility.

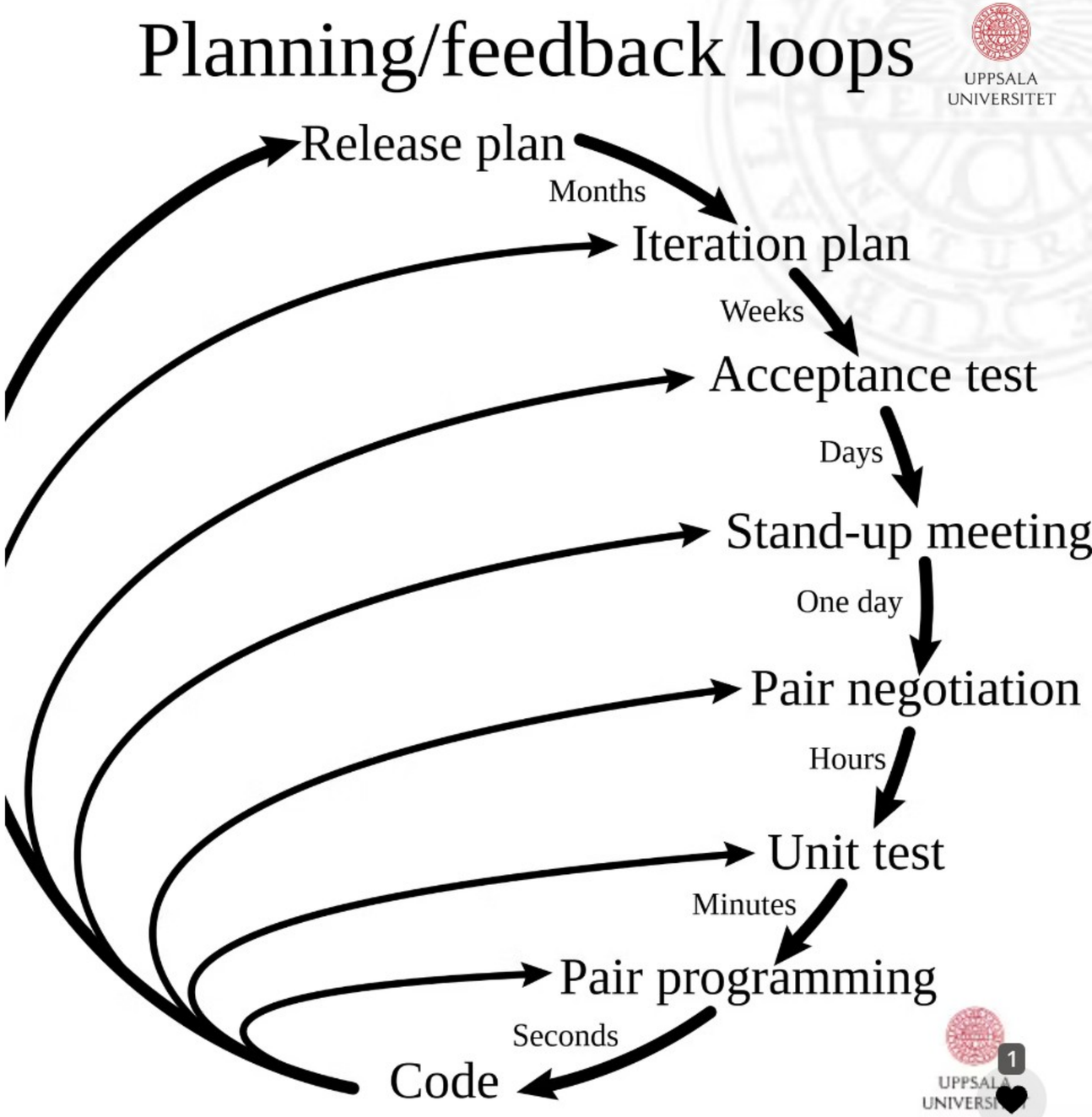
Simplicity--the art of maximizing the amount of work not done--is essential.

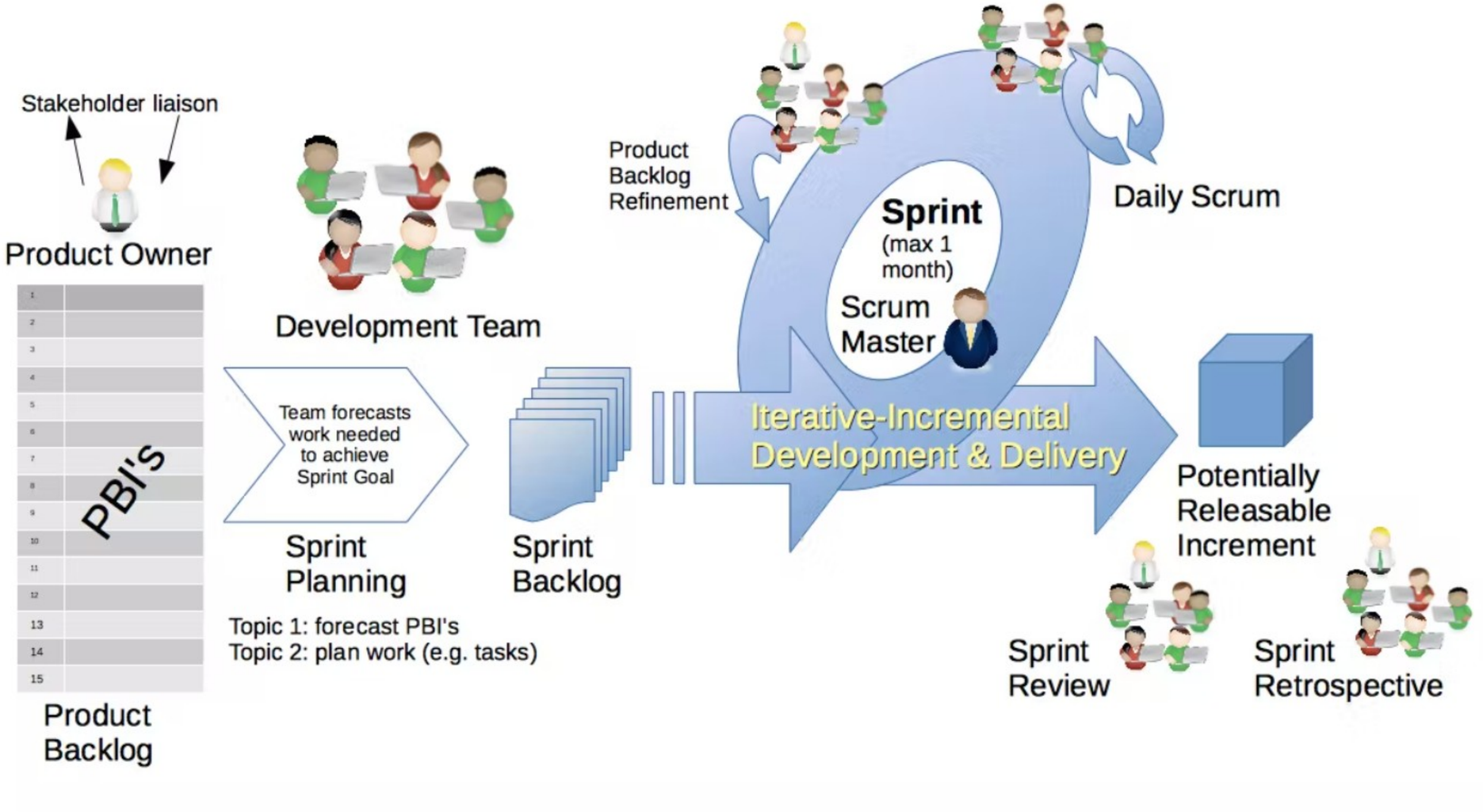
The best architectures, requirements, and designs emerge from self-organizing teams.

At regular intervals, the team reflects on how to become more effective, then tunes and adjusts its behavior accordingly.

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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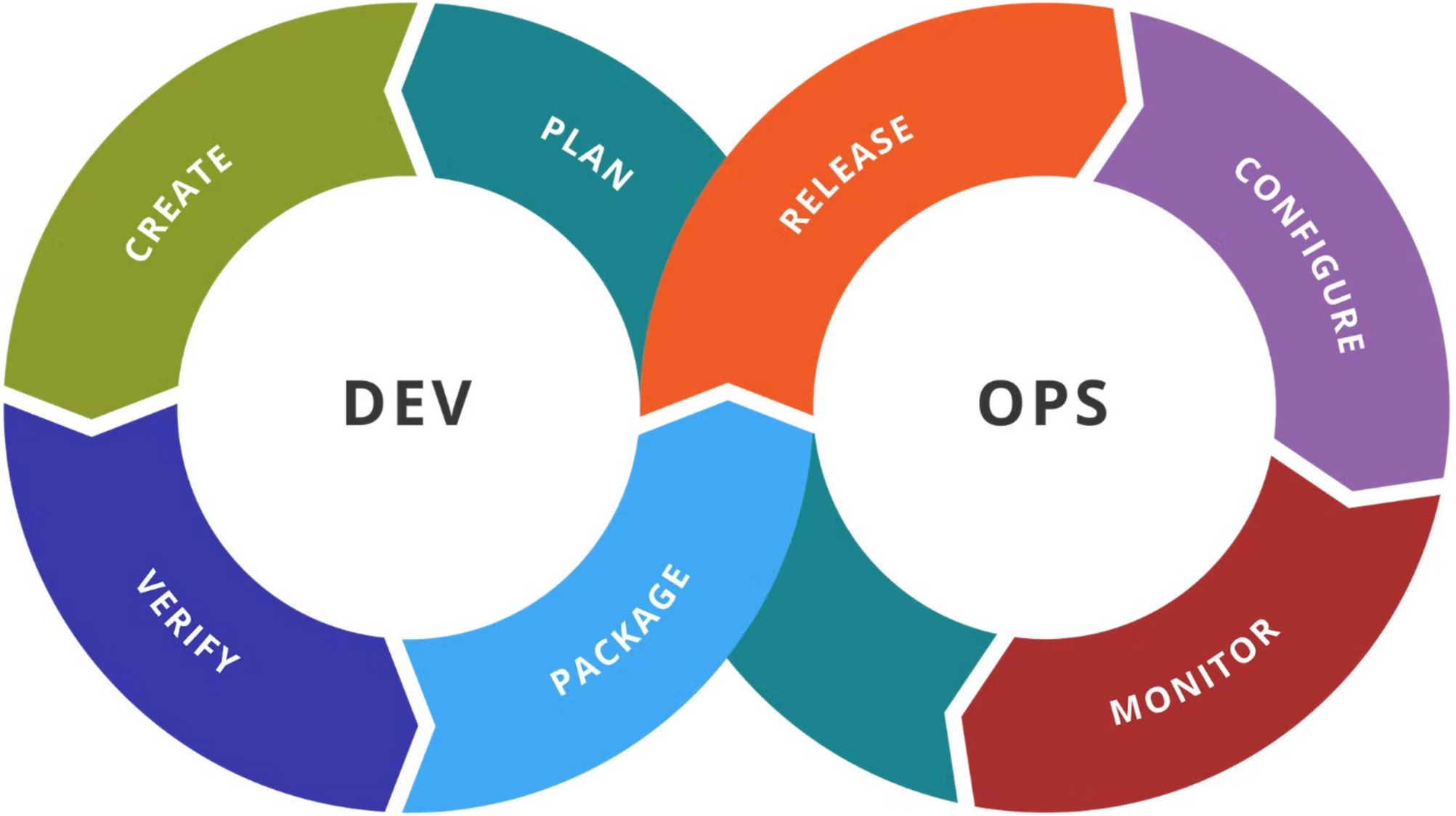

DevOps combines development and operations

Rank in order of suitable scale of project(largest to smallest)

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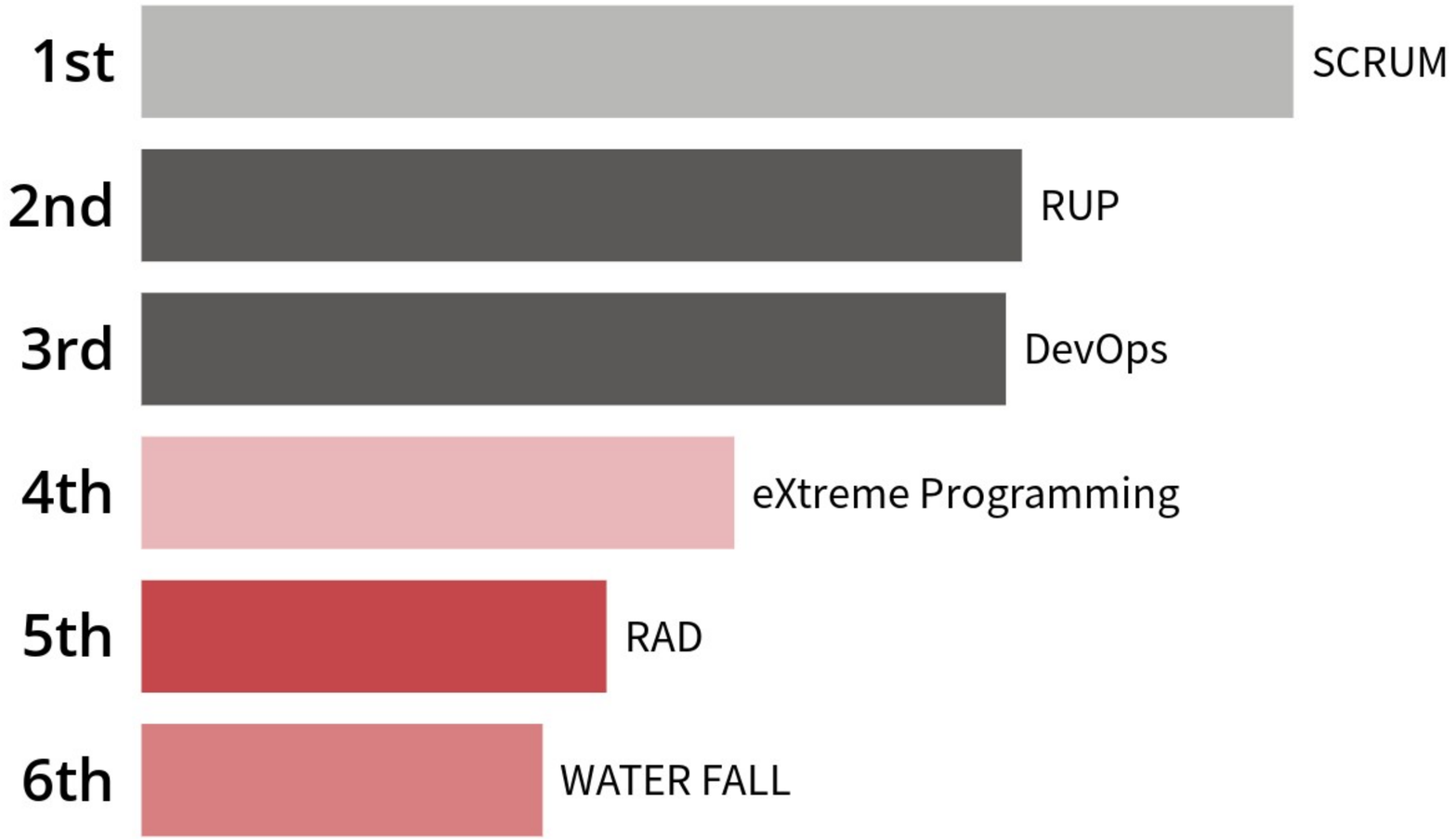

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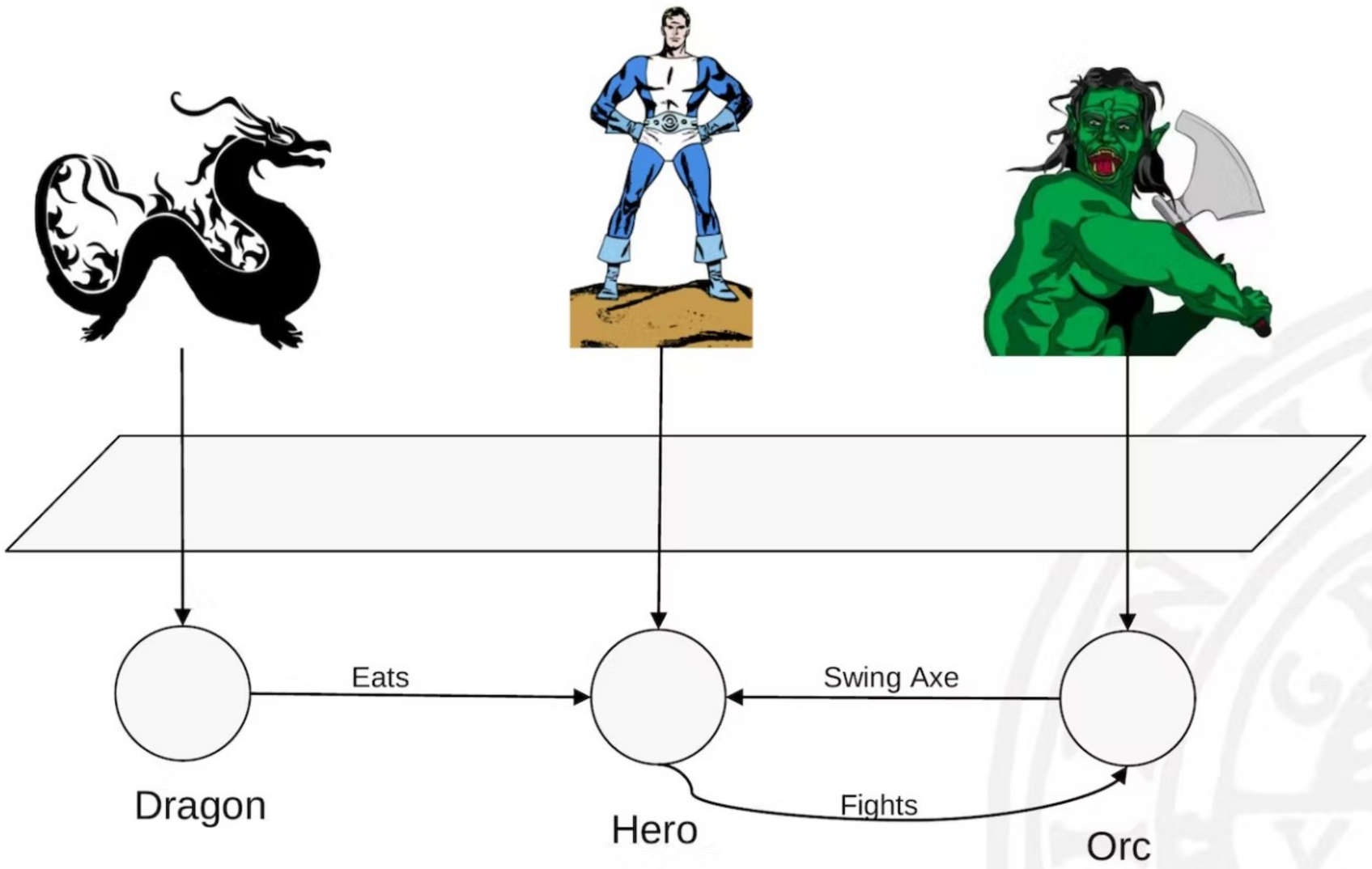
Objects And obejectorientation

Dragon

Hero

Orc



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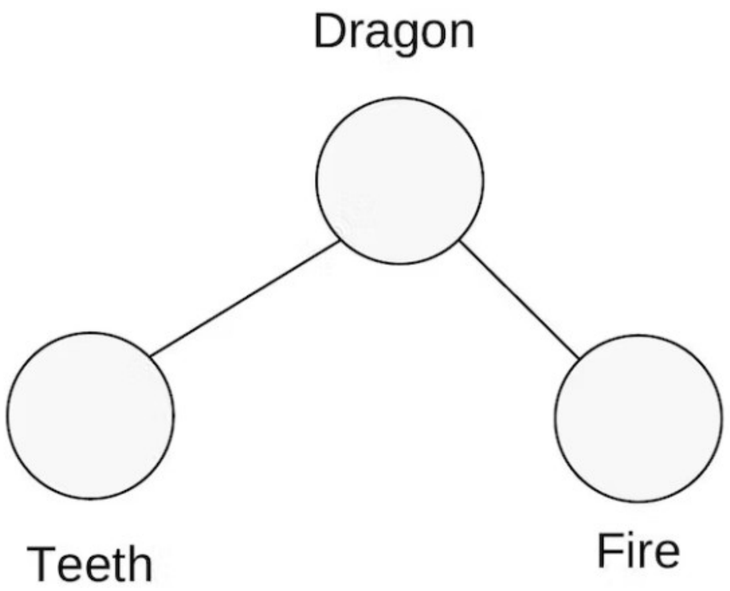
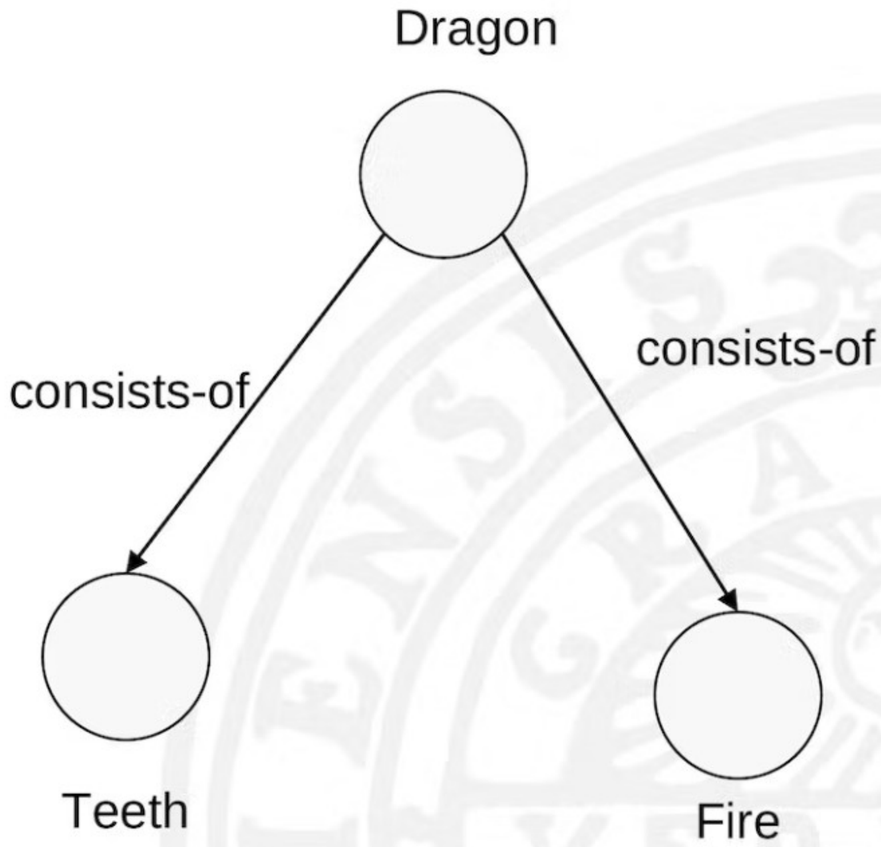
Partition



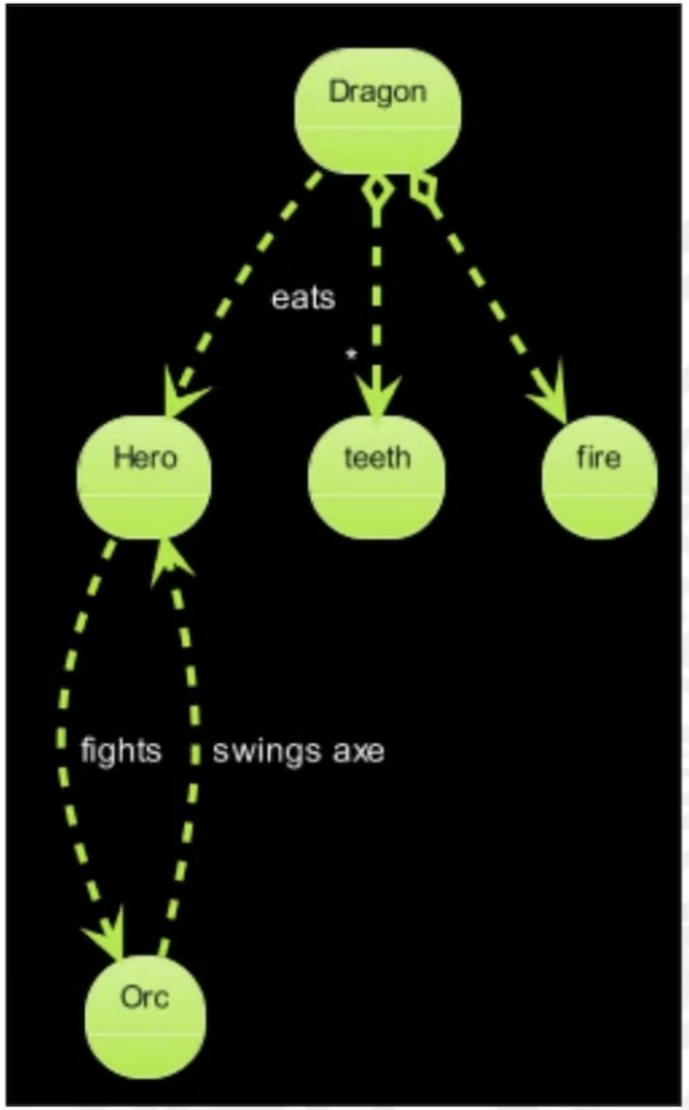
Aggregate



```
@startuml
!theme hacker
object Dragon
object Hero
object Orc
object teeth
object fire

Dragon..>Hero:eats
Hero..>Orc:fights
Orc..>Hero:swings axe
Dragon o..> “*” teeth
Dragon o..> fire

@enduml
```



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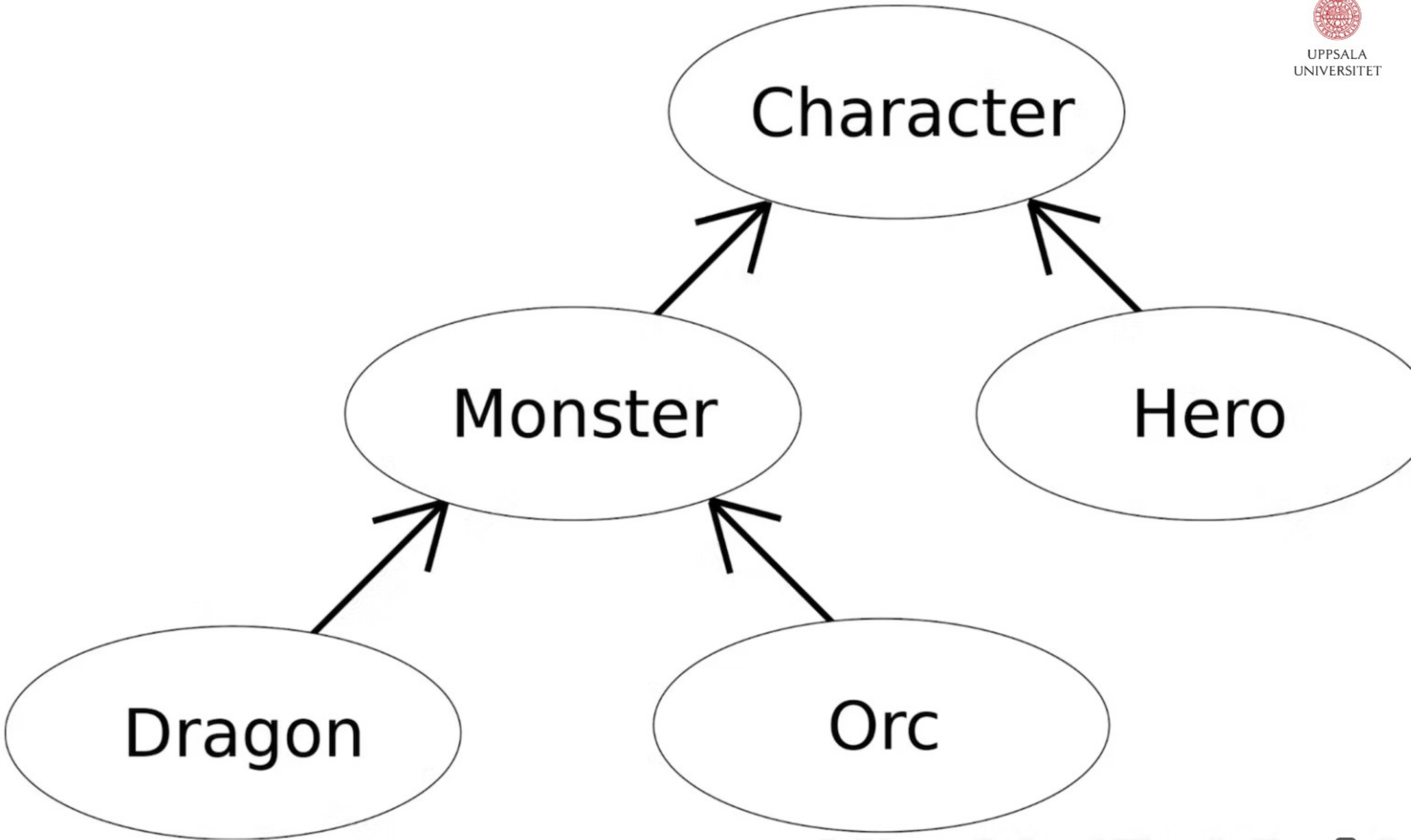

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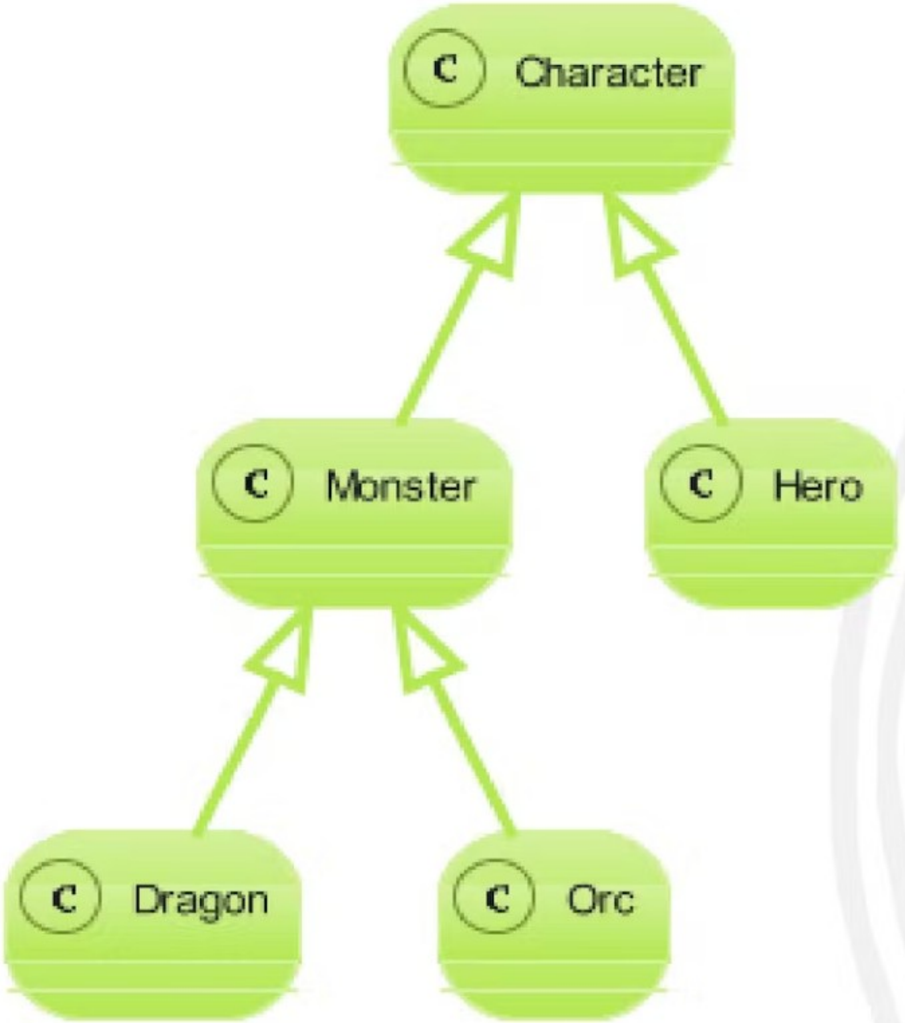
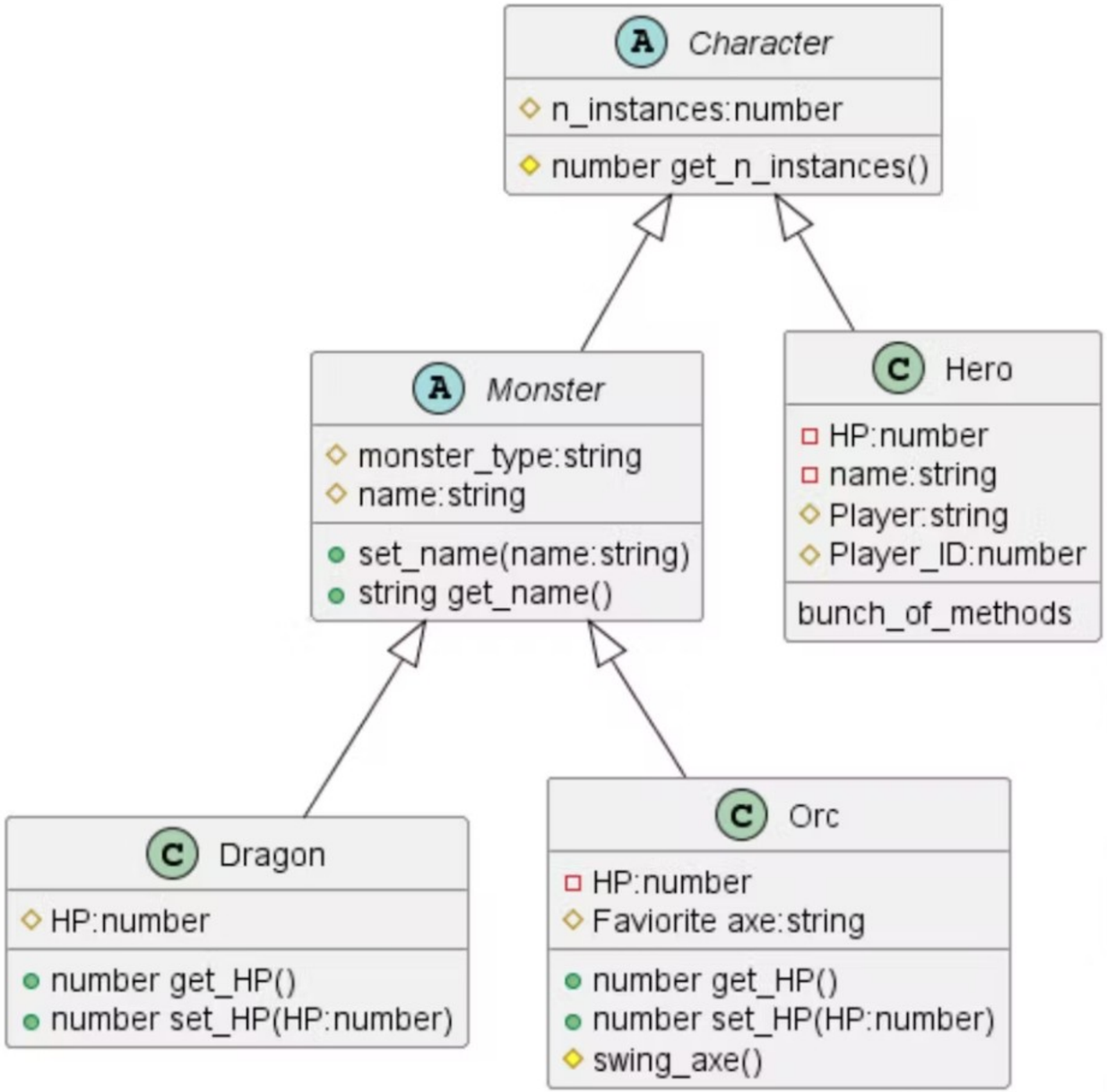
Class Diagram





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reference cheats

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

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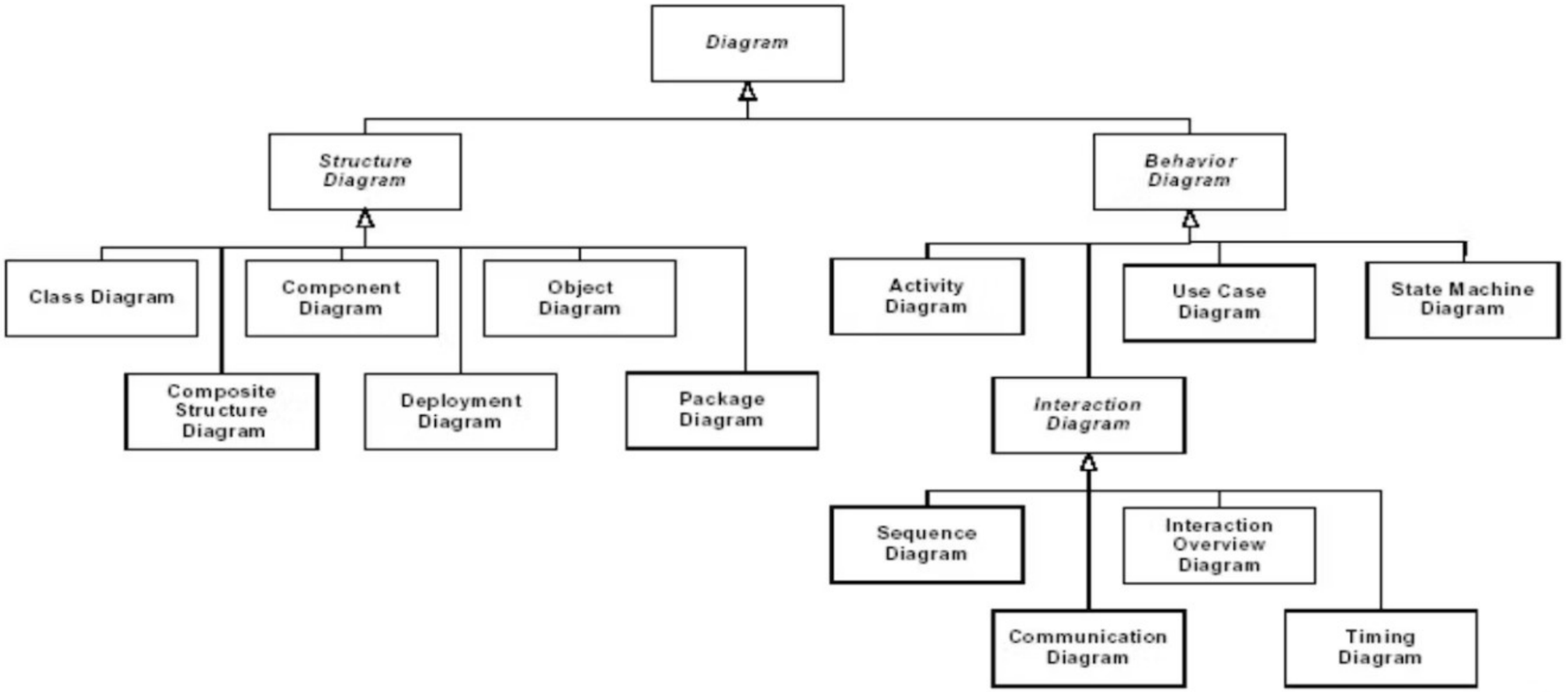
Exercise 2

Design a class hierarchy that solves the requirements from Exercise 1 (Observ does not have to be complete)

https://plantuml.com/class-diagram

https://www.tutorialspoint.com/uml/uml_class_diagram.htm

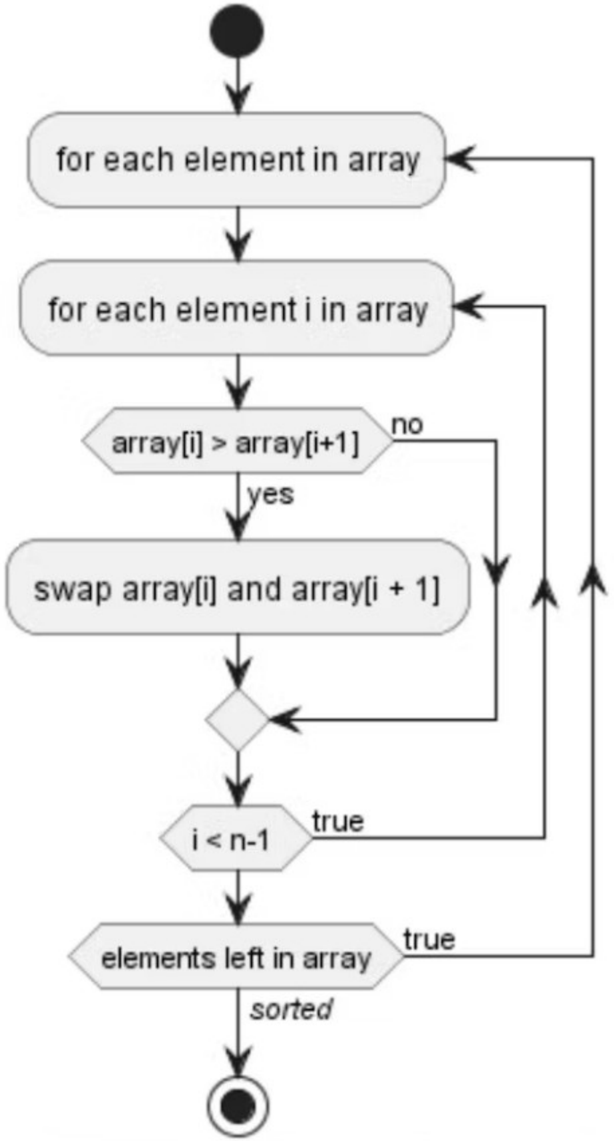
Schema of UML diagram types



Bubble Sort

```
bubble( array ):
    for each element in array:
      for each element i in array:
        if array[i] > array[i+1]: swap array[i] and array[i+1]
```

```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
```



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Exercise 3

Create a Activity diagram that shows the processes of the Needleman-Wunsch algorithm, one diagram for each of the two steps. save to your own course git from day one.
https://plantuml.com/activity-diagram-beta

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Needleman-Wunsch pseudocode for calculating F:

```
for i in length(A):
  F(i,0) = p * i
for j in length(B):
  F(0,j) = p * j
for i in length(A):
  for j in length(B):
     match = F(i-1, j-1) + S(A(i), B(j))
     delete = F(i-1, j) + p
     insert = F(i, j-1) + p
     F(i,j) = max(match, delete, insert)
```

Needleman-Wunsch pseudocode for calculating the alignment:

```
i = length(A)
j = length(B)
while ( i>0 and j>0 ):
 if (i>0 and j>0 and F(i, j) == F(i−1, j−1) + S(A(i), B(j)))
       // match! Or
        alignA = A(i) + alignA
        alignB = B(j) + alignB
        i = i − 1
        j = j − 1
    else if (i > 0 and F(i, j) == F(i−1, j) + d)
       // insertion in A or deletion in B
       alignA ← A(i) + alignA
       alignB ← "−" + alignB
       i = i − 1
    else
       // deletion in A or insertion in B
       alignA ← "−" + alignA
        alignB ← B(j) + alignB
        j = j − 1
    }
}
```