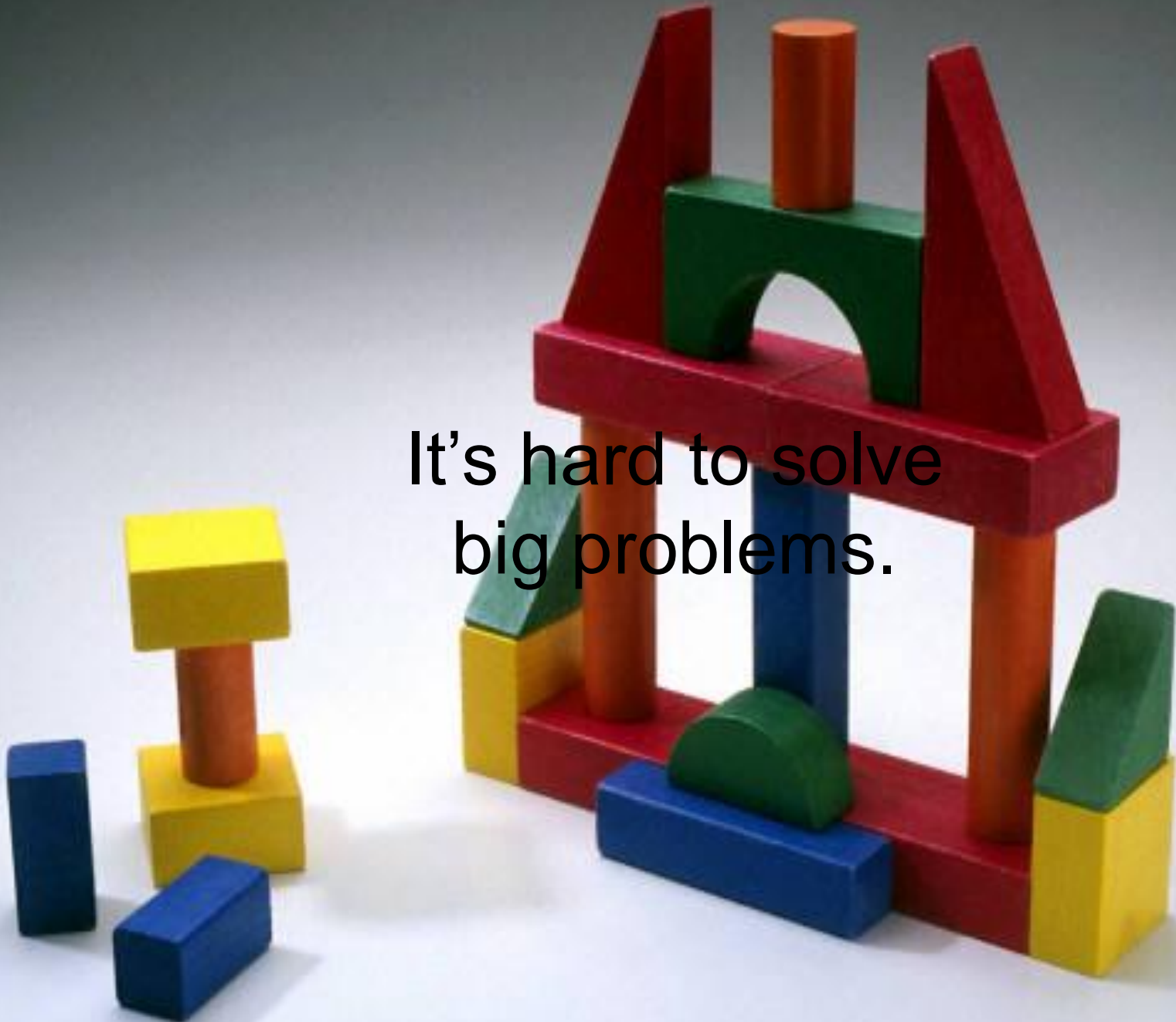


# Top-Down Design and Modular Development

It's hard to solve  
big problems.



It's easier to solve small problems than it is to solve big ones.

Computer programmers use a divide and conquer approach to problem solving:

- a problem is broken into parts
- those parts are solved individually
- the smaller solutions are assembled into a big solution

These techniques are known as ***top-down design*** and ***modular development***.

# Top-Down Design

***Top-down design*** is the process of designing a solution to a problem by systematically breaking a problem into smaller, more manageable parts.

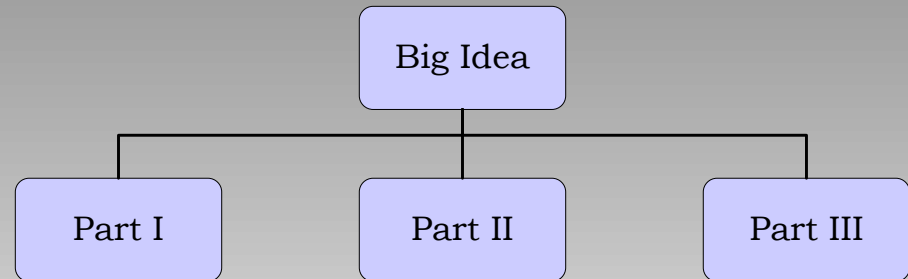
# Top-Down Design

First, start with a clear statement of the problem or concept – a single big idea.

Big Idea

# Top-Down Design

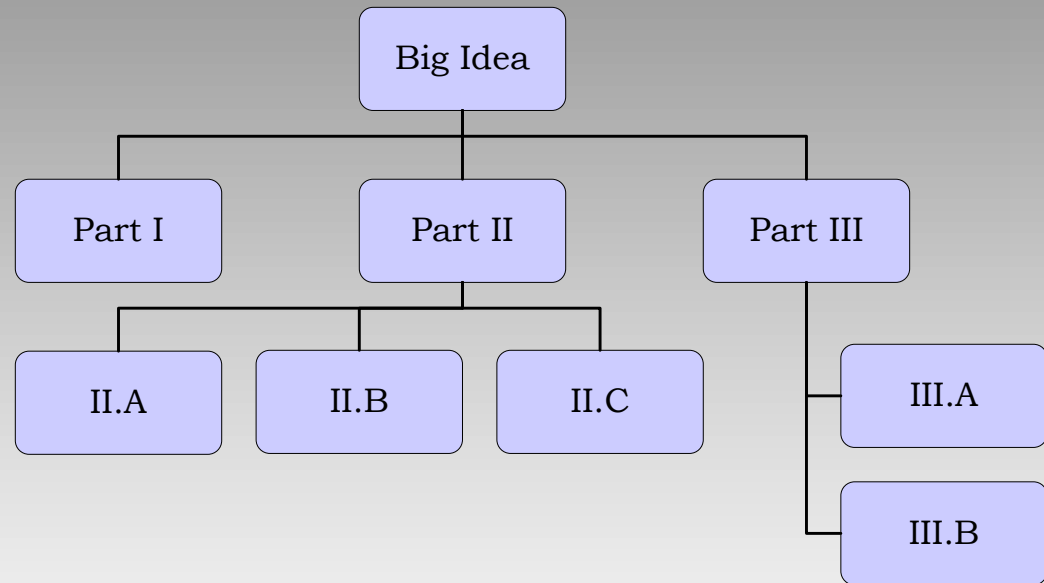
Next, break it down into several parts.



# Top-Down Design

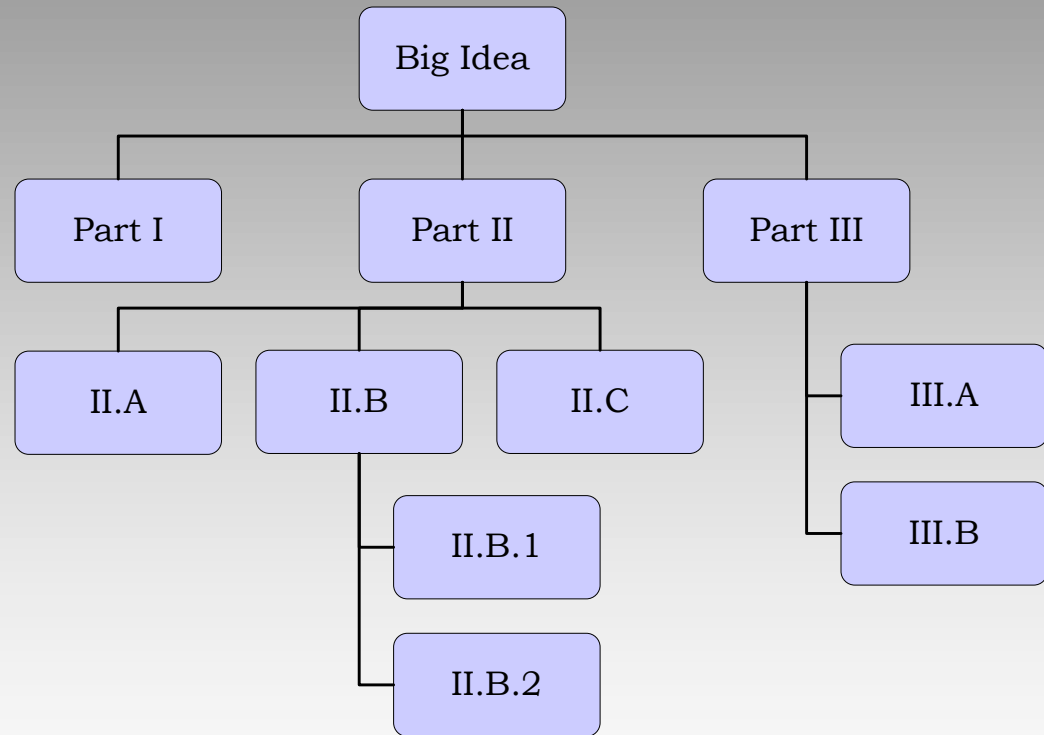
Next, break it down into several parts.

If any of those parts can be further broken down, then the process continues...



# Top-Down Design

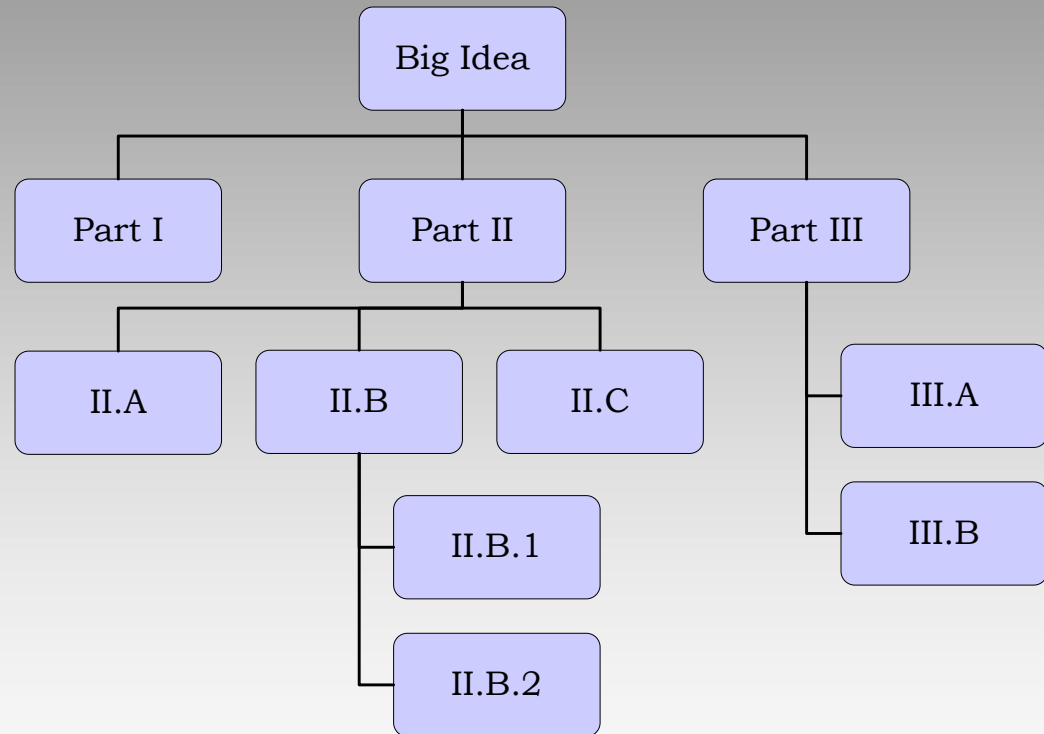
... and so on.



# Top-Down Design

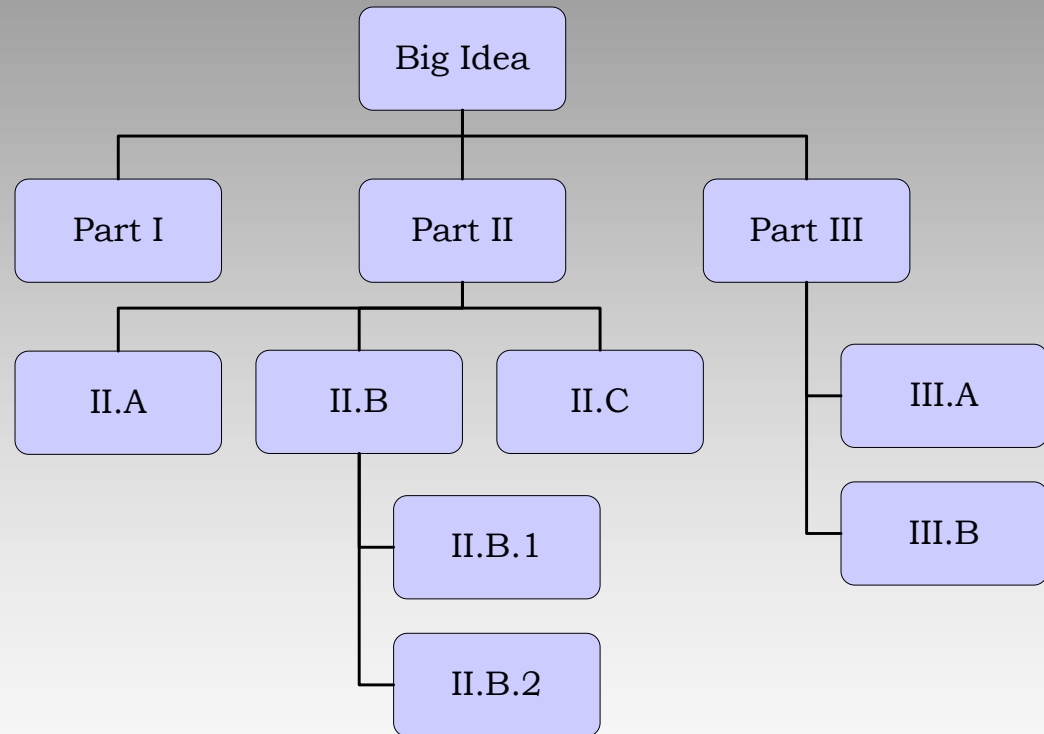
... and so on.

The final design might look something like this ***organizational chart***, showing the overall structure of separate units that form a single complex entity.



# Top-Down Design

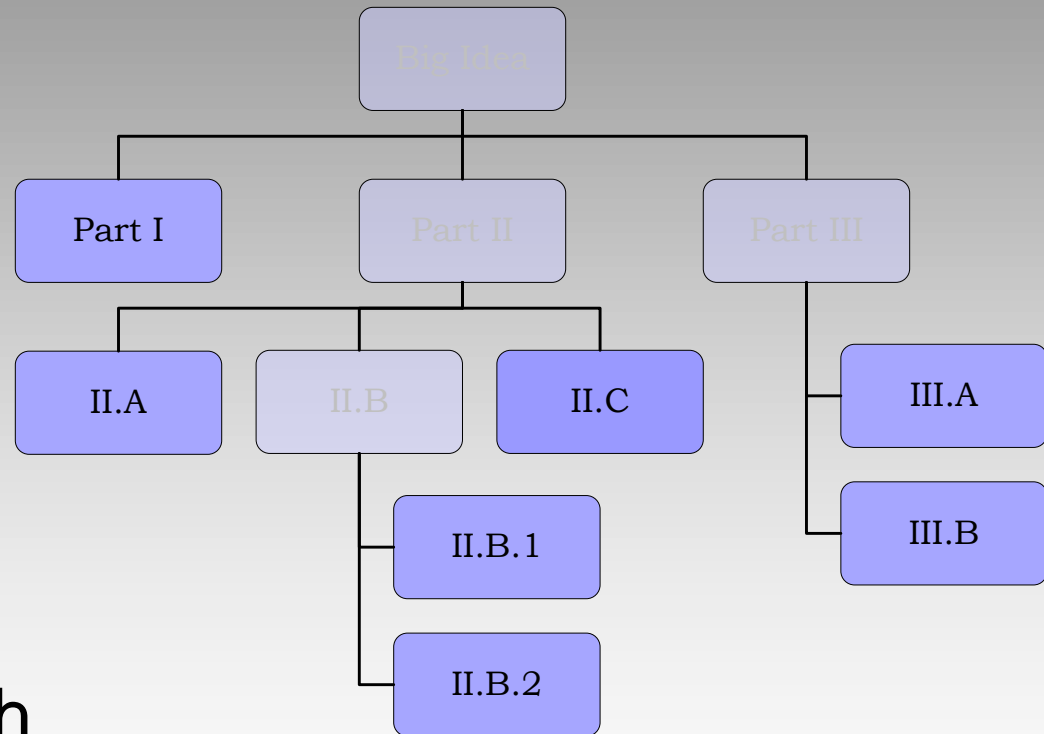
An organizational chart is like an upside down tree, with nodes representing each process.



# Top-Down Design

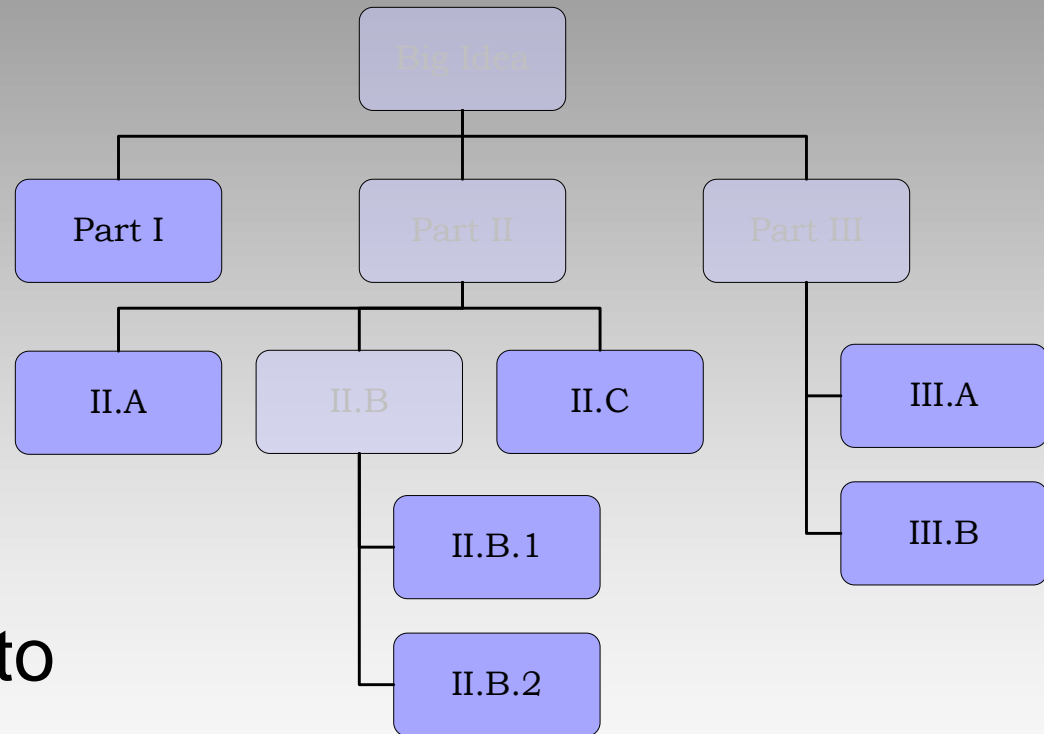
An organizational chart is like an upside down tree, with nodes representing each process.

The ***leaf nodes*** are those at the end of each branch of the tree.



# Top-Down Design

The leaf nodes represent modules that need to be developed and then recombined to create the overall solution to the original problem.

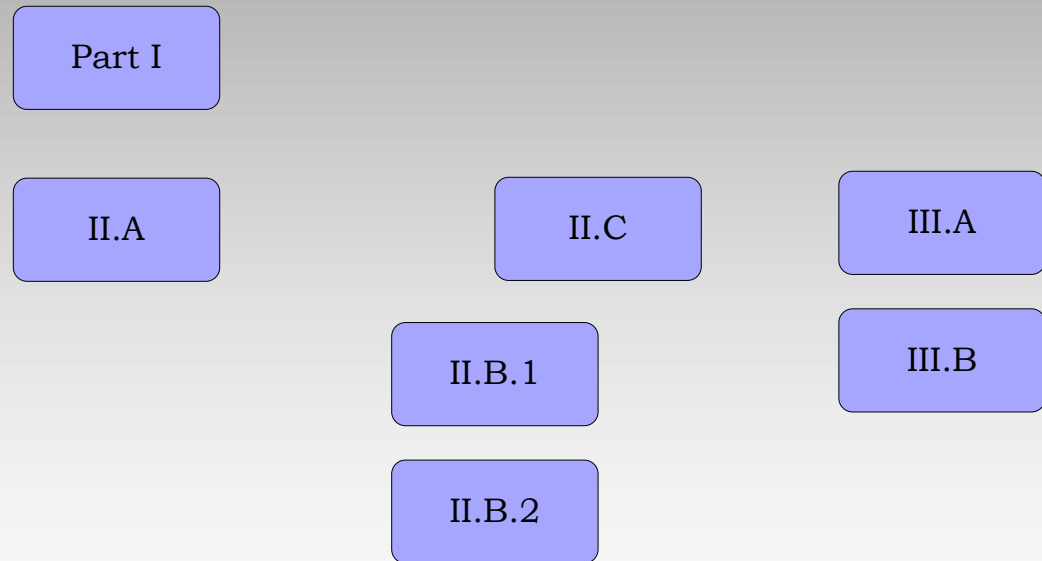


Top-down design leads to ***modular development.***

# Modular Development

## *Modular development*

is the process of  
developing software  
modules individually...

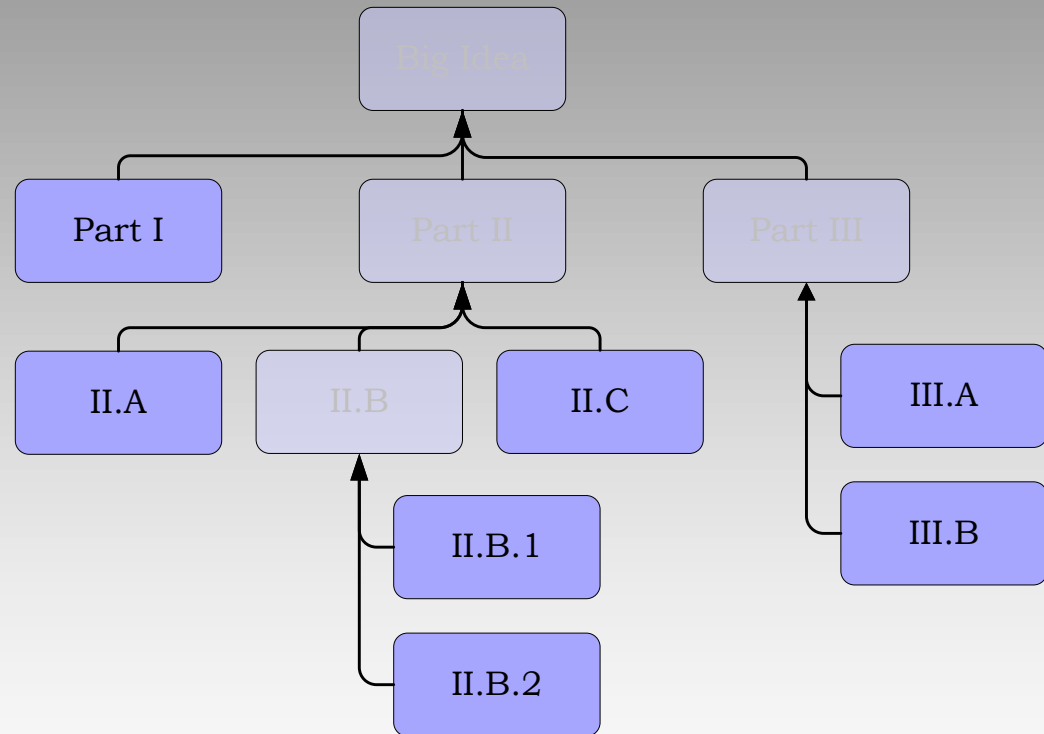


# Modular Development

## *Modular development*

is the process of developing software modules individually...

...then combining the modules to form a solution to an overall problem.



# Modular Development

Modular development of computer software:

- makes a large project more manageable
- is faster for large projects
- leads to a higher quality product
- makes it easier to find and correct errors
- increases the reusability of solutions

# Modular Development

... makes a large project more manageable.

Smaller and less complex tasks are easier to understand than larger ones and are less demanding of resources.

# Modular Development

... is faster for large projects.

Different people can work on different modules, and then put their work together. This means that different modules can be developed at the same time, which speeds up the overall project.

# Modular Development

...leads to a higher quality product.

Programmers with knowledge and skills in a specific area, such as graphics, accounting, or data communications, can be assigned to the parts of the project that require those skills.

# Modular Development

...makes it easier to find and correct errors.

Often, the hardest part of correcting an error in computer software is finding out exactly what is causing the error. Modular development makes it easier to isolate the part of the software that is causing trouble.

# Modular Development

... increases the reusability of solutions.

Solutions to smaller problems are more likely to be useful elsewhere than solutions to bigger problems.

They are more likely to be ***reusable code***.

# Modular Development

Reusable code makes programming easier because you only need to develop the solution to a problem once; then you can call up that code whenever you need it.

Most computer systems are filled with layers of short programming modules that are constantly reused in different situations.

# Modular Development

Modules developed as part of one project, can be reused later as parts of other projects, modified if necessary to fit new situations.

Over time, libraries of software modules for different tasks can be created.

Libraries of objects can be created using object-oriented programming languages.

