



Whole Picture

*Solving large problems is tough
-- but approach them logically
and you will succeed*

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Problem Solving

Large problems share many properties:

- They are daunting -- there's so much to do!
- We don't know where to begin
- Not sure we know all of the tasks that must be done to produce a solution
- Not sure we know *how* to do all of the parts -- new knowledge may be required
- Not sure it is within our capability -- maybe an expert is needed

Assume you will succeed; not trying concedes defeat



Problem Decomposition

"Divide and conquer" is a political strategy, military strategy & IT strategy
Top-level Plan --

1. Describe (in any language) a series of steps that produce a solution
2. For each step, solve it or decompose further
3. For steps needing decomposition, repeat 2
4. Assemble solutions and test correctness
5. When solution fully assembled, evaluate

3



1. Give Steps to a Solution

Specify (in any language) a series of steps that produce a solution

- For a huge problem the steps may at first be vague, but they can be (& must be) made more precise as the whole picture emerges
- The goal is an algorithm(s), so ...
- List & describe the inputs
- List & describe the outputs
- Be guided in figuring out the steps by the need to transform the inputs into the outputs

You will be naming things

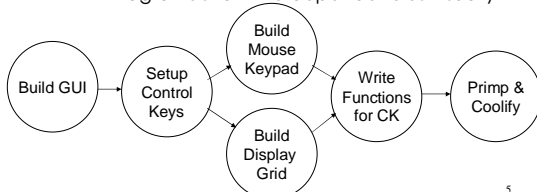
4



PERT

PERT is Program Evaluation & Review Technique ... developed in 1950s

- Diagrams show the dependencies visually



5



2&3. Solve or Decompose

For each step, solve it or decompose it further, i.e. apply same technique

- Most "top level" steps can't be brained out, and need further decomposition
- "Top level" steps often seem huge, too
- The technique allows one to concentrate on only one problem at a time
- As before, focus on inputs, outputs, process to transform inputs into outputs

Often, "last" decomposition done during solution



4. Assemble Parts

Assemble Solutions & Test Correctness

- Putting solutions together can be tough because of different assumptions made while solving the parts -- it *always* happens
- When working alone it is common to combine parts along the way and to test continuously
- Because of the need to test, pick a good order to solve the problems

Getting something working quickly is best

7



Summary

Large problems can be solved by the 'divide and conquer' technique

- The process is "top down" -- get a top level solution even if it is vague, imprecise
- Whenever you cannot produce a solution to a step directly, reapply the technique
- The start and first several steps will be daunting ... but the process works!
- Get part of solution working quickly if possible

8