Whole Picture

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

Problem Solving

Large problems share many properties:

- They are daunting -- there’s so much to do!
- We don’t know were 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

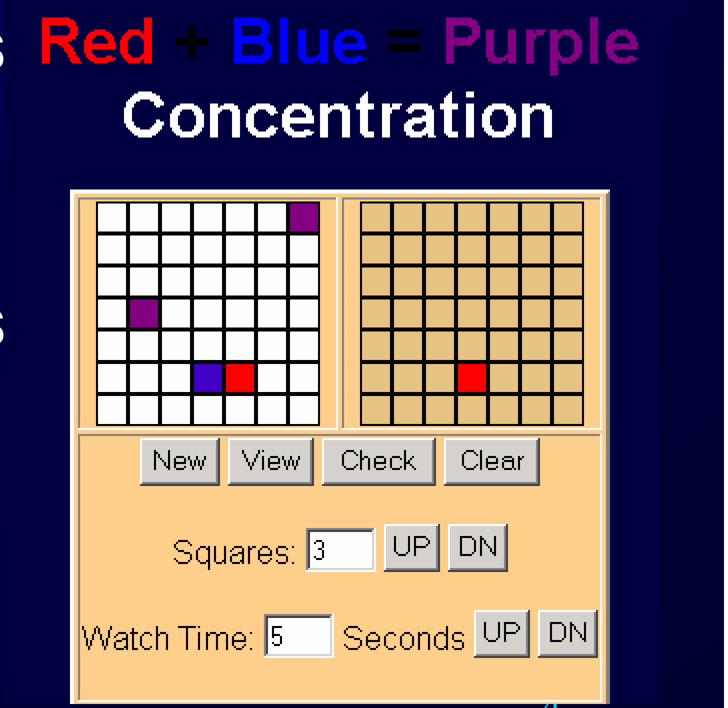
Top-level Plan --

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

More Specifics

We will step through the process, using an old Project 2 as an example:

- Problem decomposition is mostly common sense
- Process is not algorithmic
- Problem decomposition is to help you, so apply it as needed



Red + Blue = Purple

Concentration

Squares: 3

Watch Time: 5 Seconds

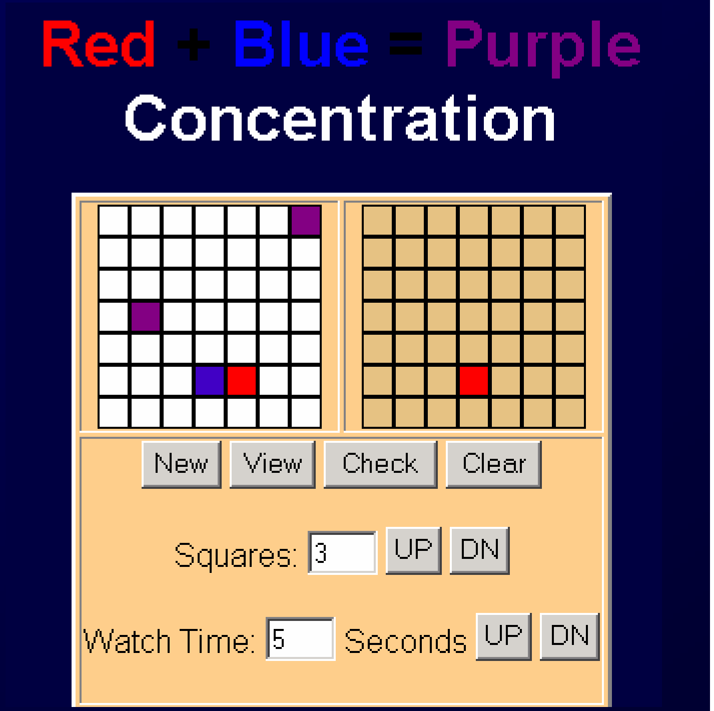
1. Give Steps to a Solution

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

What Are Steps for PC?



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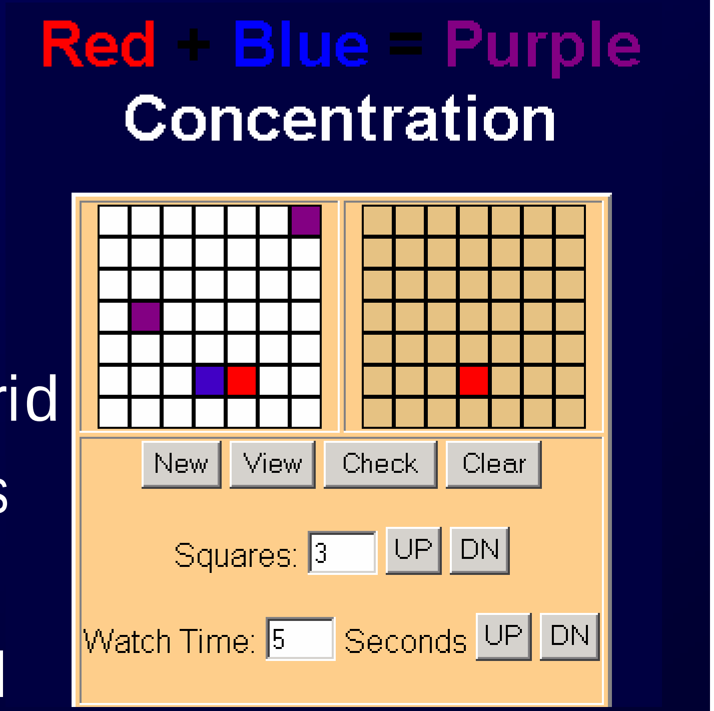
What Are Steps for PC?

Purple Concentrate:

- Build Basic GUI
- Set up control keys
- Build the Display Grid
- Build mouse-sensed KeyGrid
- Write functions for ctrl keys
- Set up customizing keys
- Primp design & make cool



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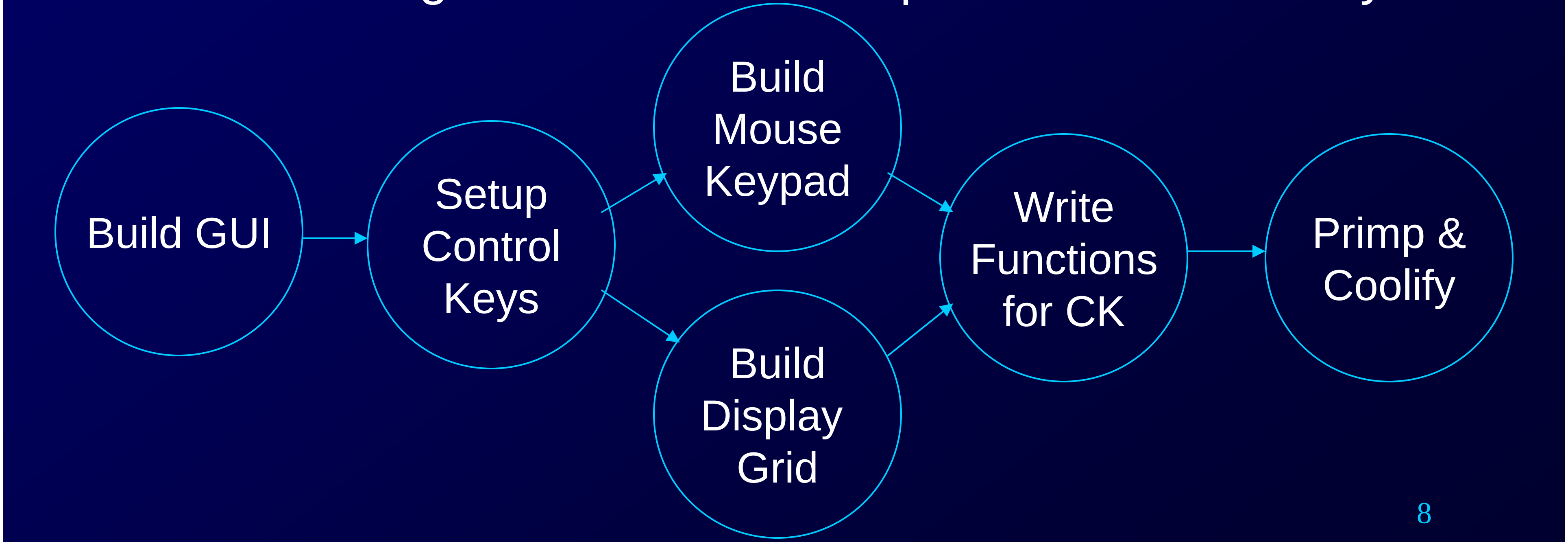
PERT

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

- Diagrams show the dependencies visually



2&3. Solve or Decompose

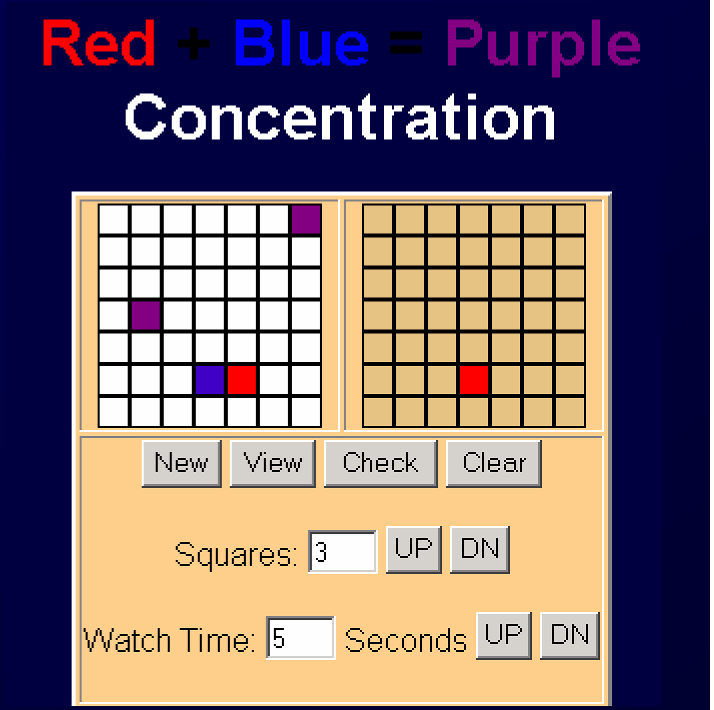
For each step, solve it or decompose it further, i.e. apply same technique

- 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

2&3. Solve or Decompose

"Build mouse-sensed keypad"



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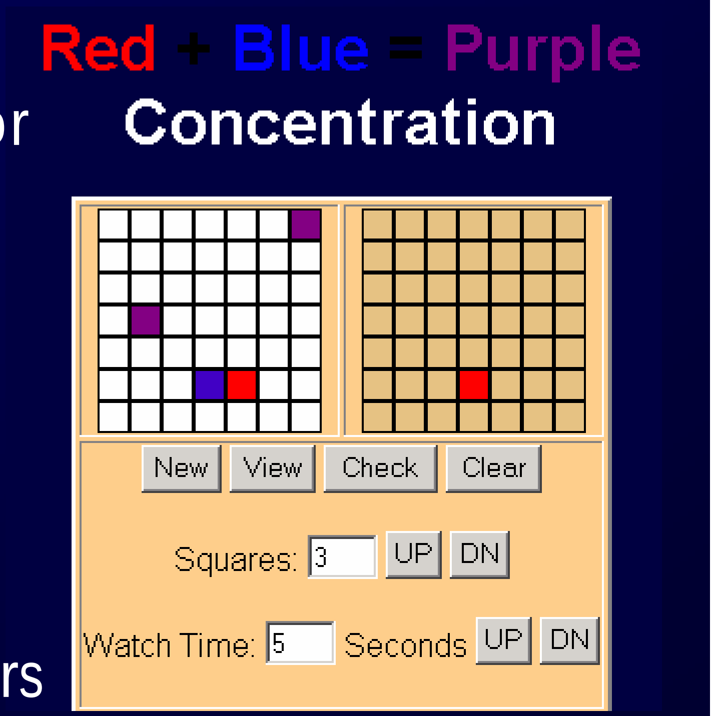
2&3. Solve or Decompose

“Build mouse-sensed keypad”

- Layout GIF 7x7 grid
- Setup to change grid color
- Build onClick e-handler

  …

- Define GIF prefetch array
- Prefetch brown & orange
- Build mouse e-handlers
- Update colors in e-handlers



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Need to learn about mouse events

4. Assemble Parts

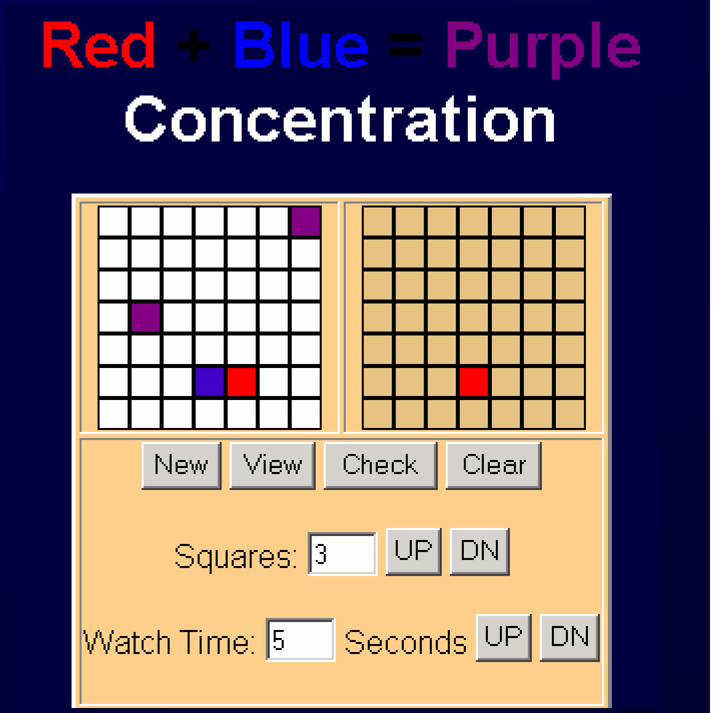
Assemble Solutions &Test Correctness

- 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

4. Assemble Parts

Proj2 solves & assembles parts together in a ‘good’ order



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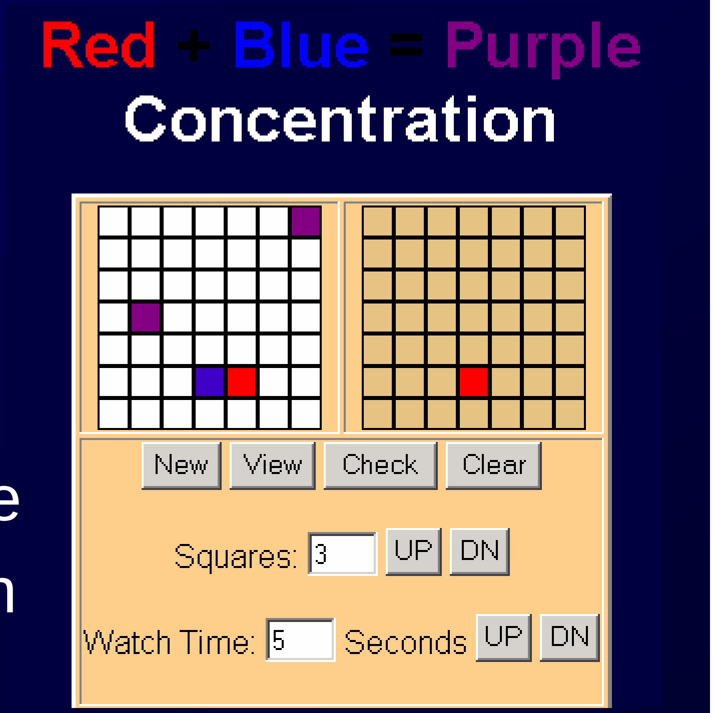
4. Assemble Parts

Proj2 solves & assembles parts together in a ‘good’ order

- Most parts of Project 2 use the developing solution for testing -- that’s ‘good’
- Notice adding steps to test a solution may be wise
- Parts mismatch is common problem, but not in Proj2



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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