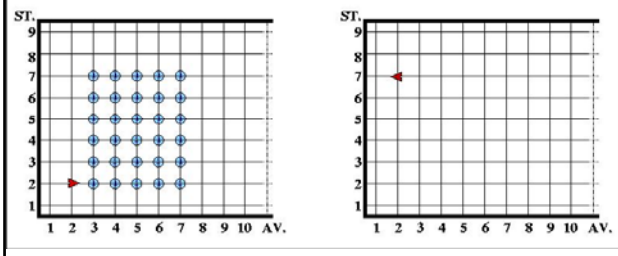
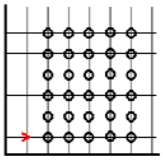
Stepwise Refinement

- **A *program design strategy* where a solution is first described in terms of high level functions, then each function is broken down into details that are refined in successive steps until the whole program is fully defined.**

Harvest Task

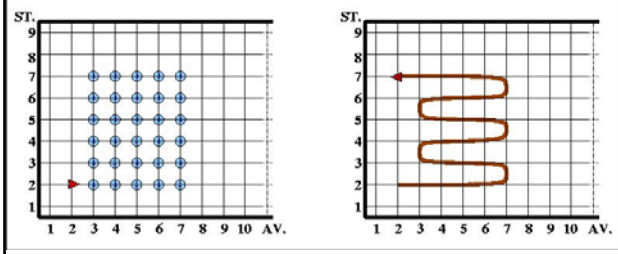


<u>Stepwise Refinement</u> helps us write "good" programs



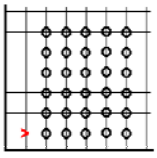
- **Stepwise Refinement tells us not to delve into details too quickly, but to gradually solve the problem by breaking it into smaller sub-problems.**
- **Each sub-problem is then solved (also using stepwise refinement.)**
- **Eventually our solutions are expressed in detailed terms.**

Harvest Task



We might solve the harvest problem as follows:

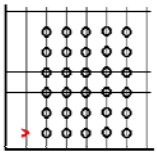
```
move()
harvest_2_rows()
position_for_next_2()
harvest_2_rows()
position_for_next_2()
harvest_2_rows()
move()
turn_off()
```



The commands harvest_2_rows() and position_for_next_2() are new commands, so the next step is to write these commands.

We might write the first new command as:

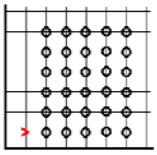
```
def harvest_2_rows()
    harvest_a_row()
    go_to_next_row()
    harvest_a_row()
```



We must now define the commands
harvest_a_row() and go_to_next_row()

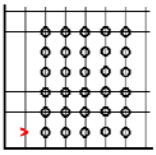
```
def go_to_next_row()
    turn_left()
    move()
    turn_left()

def harvest_a_row()
    pick_beeper()
    move()
    pick_beeper()
    move()
    pick_beeper()
    move()
    pick_beeper()
    move()
    pick_beeper()
```



All we lack to finish this program is to define the instruction position_for_next_2()

```
def position_for_next_2()
{
    turn_right()
    move()
    turn_right()
}
```



The final step is to combine all of the definitions (plus a definition of turn_right()) into a complete program.

Stepwise Refinement (another definition)

- **The software design technique that aims to describe functionality at a very high level, then partition it repeatedly into more detailed levels (one level at a time) until the detail is sufficiently refined to express directly as code.**
- **Also called *top-down design*.**