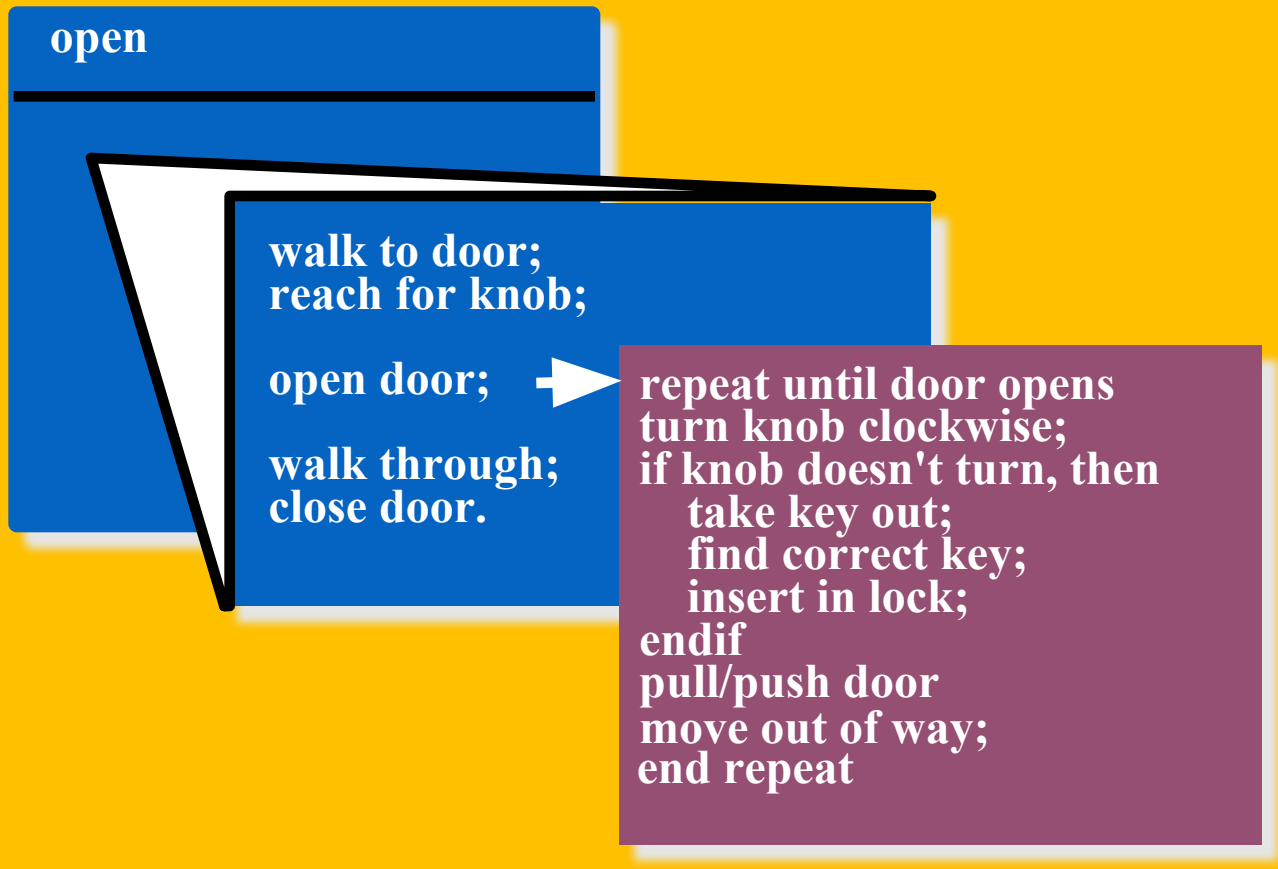
Component-Level Design

Component-Level Design

- the closest design activity to coding
- the approach:
  - review the design description for the component
  - use stepwise refinement to develop algorithm
  - use structured programming to implement procedural logic
  - review and iterate as required

Stepwise Refinement



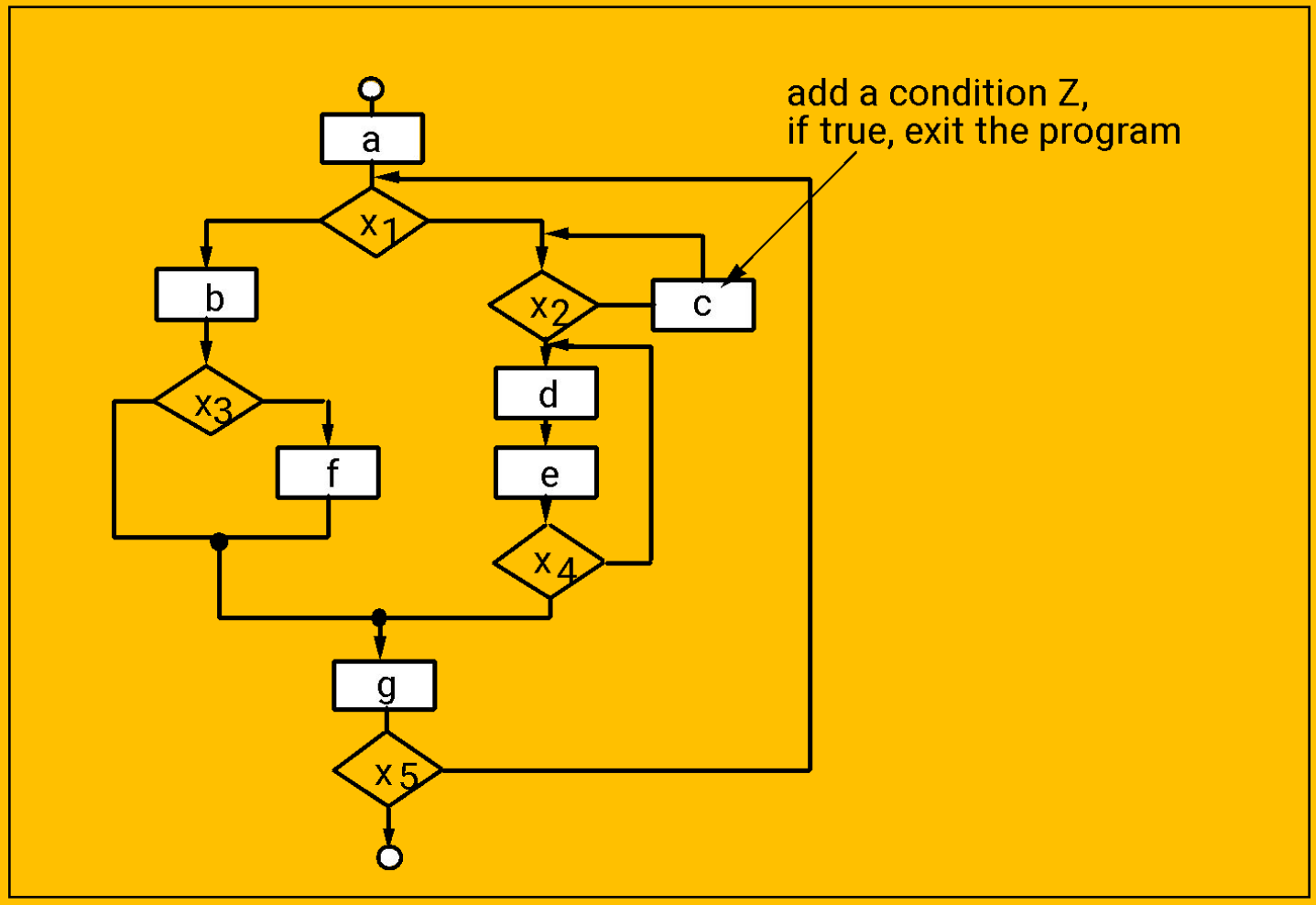
The Component-Level Design Model

- represents the algorithm at a level of detail that can be reviewed for quality
- options:
  - graphical (e.g. flowchart, box diagram)
  - pseudocode (e.g., PDL) ... choice of many
  - programming language
  - decision table
  - conduct walkthrough to assess quality

Structured Programming for Procedural Design

- uses a limited set of logical constructs:
  - *sequence*
  - *conditional* — if-then-else, select-case
  - *loops* — do-while, repeat until
- leads to more readable, testable code
- important for achieving high quality, but not enough

A Structured Procedural Design



Tabular Design Notations Using Decision Tables

DT is divided into four sections

1. Upper left-hand quadrant contains all conditions
2. Lower left-hand quadrant contains all actions
3. Upper Right-hand quadrant contains conditions combinations
4. Lower Right-hand quadrant contains corresponding actions to conditions

	Rules								
Conditions	**1**	**2**	**3**	**4**					n
Condition #1	✓			✓	✓				
Condition #2		✓		✓					
Condition #3			✓		✓				
Actions									
Action #1	✓			✓	✓				
Action #2		✓		✓					
Action #3			✓						
Action #4			✓	✓	✓				
Action #5	✓	✓			✓				

Decision table nomenclature

Example

You must decide how to dress for the weather. The conditions are that it may or may not be cloudy and it may or may not be cold. If it is cloudy, take an umbrella. If it is cold, take a coat.

Conditions	Combinations of Conditions			
Cloudy	Y	Y	N	N
Cold	Y	N	Y	N
Actions	**Combinations of Actions**			
Take umbrella	X	X		-
Take Coat	X		X	-

Example

Conditions	Combinations of Conditions			
Important	Y	Y	N	N
Urgent	Y	N	Y	N
Actions	**Combinations of Actions**			
Do	X			
Plan		X		
Delegate			X	
Eliminate				X

Practice Example:

- Conditions:
  - Valid user ID
  - Valid password
  - Sufficient Balance

- Actions
  - Login accepted
  - Amount transferred

Solution:

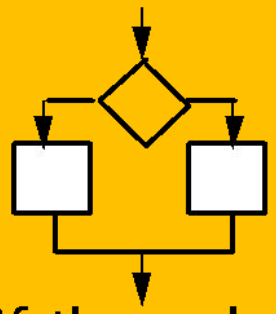
Conditions	Combinations of Conditions							
Valid User Name	Y	Y	Y	Y	N	N	N	N
Valid ID	Y	Y	N	N	Y	Y	N	N
Sufficient Balance	Y	N	Y	N	Y	N	Y	N
Actions	**Combinations of Actions**							
Login accepted	T	T	F	F	F	F	F	F
Amount Transferred	T	F	F	F	F	F	F	F

Program Design Language (PDL):

- **Program design language (PDL), also called *structured English* or *pseudo code*. It uses the vocabulary of one language (i.e., English) and the overall syntax of another (i.e., a structured programming language)**

- ***The difference* between PDL and a real programming language lies in the use of narrative text (e.g., English) embedded directly within PDL statements.**

- **PDL tools currently exist to *translate* PDL into a programming language (such as C and ADA) "skeleton" and/or a graphical representation.**



if-then-else

```
if condition x
  then process a;
  else process b;
endif
```

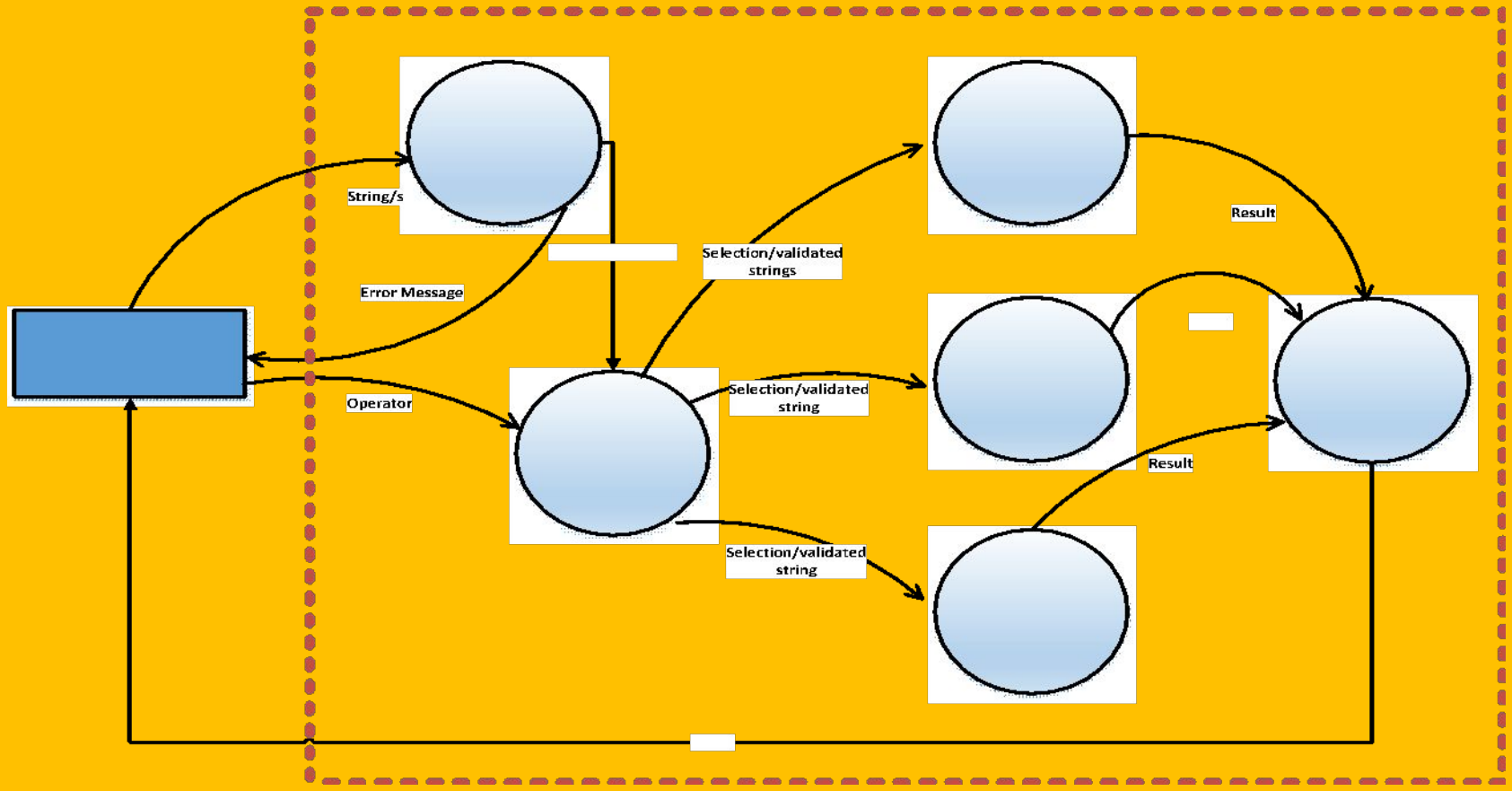
PDL

- easy to combine with source code
- machine readable, no need for graphics input
- graphics can be generated from PDL
- enables declaration of data as well as procedure
- easier to maintain

Why Design Language?

- can be a derivative e.g., Ada PDL
- machine readable and processable
- can be embedded with source code, therefore easier to maintain
- can be represented in great detail, if designer and coder are different
- easy to review

Example:


String/s
Error Message
Operator
Selection/validated strings
Selection/validated string
Selection/validated string
Result
Result

```
Char* concat(char* S1, char *S2)
{
        char* newstr = new char[Len(S1) + Len(S2)];
        int c=0;
        for (i=0; i<Len(S1); i++)
                newstr[c++] = S1[i];
        newstr[c++] = ' ';
        for (i=0; i<Len(S2); i++)
                newstr[c++] = S2[i];
        newstr[c]='\0';
        return newstr;
}
```