

modelling state

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<http://www.hcibook.com/alan/topics/formal/>

model based methods

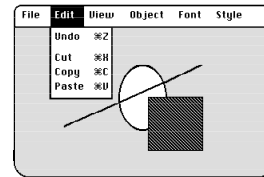
- describe state using variables
- types of variables:
 - basic type:
x: Nat – non-negative integer {0,1,2,...}
 - individual item from set:
shape: {circle, line, rectangle}
 - subset of bigger set:
selection: **set** Nat – set of integers
 - function (often finite):
objects: Nat $\rightarrow$ Shape_Type

define your own types

Shape_Type =

shape: {circle, line, rectangle}
x, y: Nat – position of centre
wid: Nat
ht: Nat – size of shape

use them to define state



objects: Nat $\rightarrow$ Shape_Type
selection: set Nat – selected objects

invariants and initial state

invariants – conditions that are always be true
– must be preserved by every operation

selection $\subseteq$ dom objects – selection must consist of valid objects

initial state – how the system starts!

objects = {} – no objects
selection = {} – selection is empty

finally define operations

delete:

dom objects' = dom objects – selection – remove selected objects
$\forall$ id $\in$ dom objects' objects'(id) = objects(id) – remaining objects unchanged
selection' = {} – new selection is empty

✍ note use of primed variables for 'new' state

defining state

two problems:

- too little state
 - elements missing from specification
 - may be deliberate
 - e.g. dialogue level spec.
- too much state
 - too many states, too complex state
 - may be deliberate
 - redundancy, extensibility

too little state

- forgotten elements
 - e.g. 'typing' flag for calculator
- checking:
 - dialogue state
 - can you work out current dialogue state?
 - action specification
 - do you have enough information?
 - implicit global variables (see also later)
 - suggest state missing

too much state

- unreachable states
 - too few actions (see later)
 - constraints
- states are not orthogonal
- spare variables: constant/functional dependent
 - dependent state
 - e.g. first point of line, number being typed
 - indistinguishable states
 - what is observable?

defining actions

- framing problems
 - = too little in result state
- unreachable states – insufficient actions
- using 'global' variables
 - implicit in operation definition
- beware extreme cases
 - (e.g. empty document, cursor at end of line)