

ALLOY MODELING
LANGUAGE

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ALLOY LOGIC
WRAP-UP

RELATION MULTIPLICITIES

- TOO BIZARRE FOR WORDS

- ALMOST

- $r: A \ m \rightarrow n \ B$ MEANS:

EXAMPLES:

$r: A \rightarrow$ **one** B

$r: A$ **one** $\rightarrow B$

$r: A \rightarrow$ **lone** B

$r: A$ **one** \rightarrow **one** B

$r: A$ **some** \rightarrow **some** B

- **EACH** MEMBER OF A MAPS TO n MEMBERS OF B

- **AND FOR EACH** MEMBER OF B , m MEMBERS OF A MAP TO IT

```
sig Thing, OtherThing {}
```

```
pred relMult[r: Thing some  $\rightarrow$  some OtherThing] {}
```

```
run relMult for 3
```

OLD Q8

CARDINALITY CONSTRAINTS

- #e GIVES THE SIZE (NUMBER OF TUPLES) IN THE RELATION GIVEN BY e

- CAN USE ALL REGULAR INTEGER OPERATIONS ON THE RESULT

- CAN USE 1, 2, 3, ... AS CONSTANTS

- **sum** x: e | ie MEANS $\sum_{x \in e} ie$



ALLOY MODELING
LANGUAGE

ALLOY LANGUAGE

- BASED ON THE LOGIC
- ADDS STRUCTURING TOOLS:
 - MODULES
 - COMPOSITION
 - RE-USE
- ADDS SYNTACTIC SUGARS



MOSTLY
“NORMAL”

EXTENDED EXAMPLE

- SELF-GRANDPAS
- BACKGROUND:
- <http://www.youtube.com/watch?v=W7x1ETPkZsk>



SIGNATURES

SIGNATURES

■ INTRODUCE SETS OF ATOMS

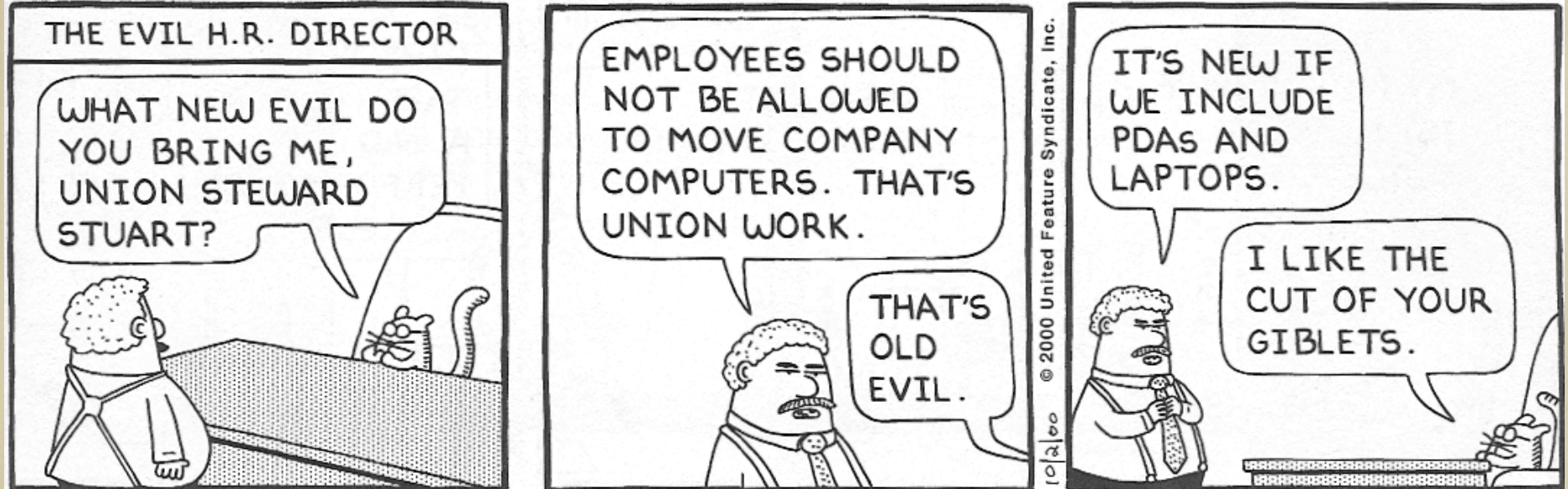
NO ELEMENTS
EXCEPT IN
EXTENSIONS

TOP-LEVEL
SIGNATURE

abstract sig Person {}
sig Woman **extends** Person {}
sig Man **extends** Person {}

EXTENSIONS
ARE DISJOINT

CARTOON OF THE DAY



SUBSET SIGNATURES

- ALLOW MULTIPLE CLASSIFICATION HIERARCHIES

- EXAMPLES:

NOT NECESSARILY
DISJOINT

```
graph TD; A[NOT NECESSARILY DISJOINT] --> B["sig Faculty in Person {}"]; A --> C["sig Staff in Person {}"]; D[EMPLOYEES AREN'T NECESSARILY IN BOTH] --> E["sig Employee in Faculty + Staff {}"];
```

- **sig** Faculty **in** Person {}
sig Staff **in** Person {}
sig Employee **in** Faculty + Staff {}

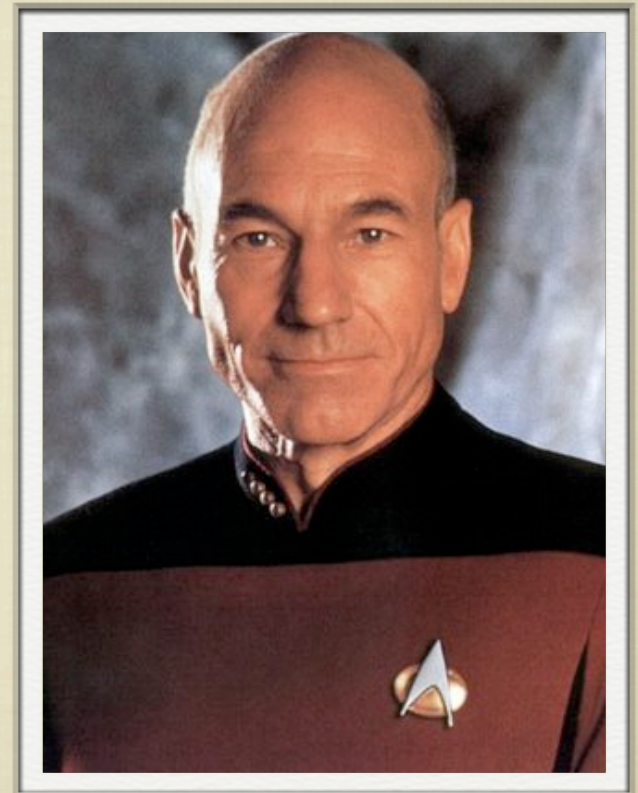
EMPLOYEES AREN'T
NECESSARILY IN BOTH

EXAMPLE

```
sig Tea {}  
sig IndiaTea, ChinaTea extends Tea {}  
sig Assam, Darjeeling extends IndiaTea {}  
sig Keemun extends ChinaTea {}  
sig EarlGrey in ChinaTea + IndiaTea {}
```

// **Multiple inheritance**

```
sig FlavoredTea in Tea {}  
sig JasmineTea extends ChinaTea {}  
fact { JasmineTea in FlavoredTea }
```



CONSTRAINING SIGS

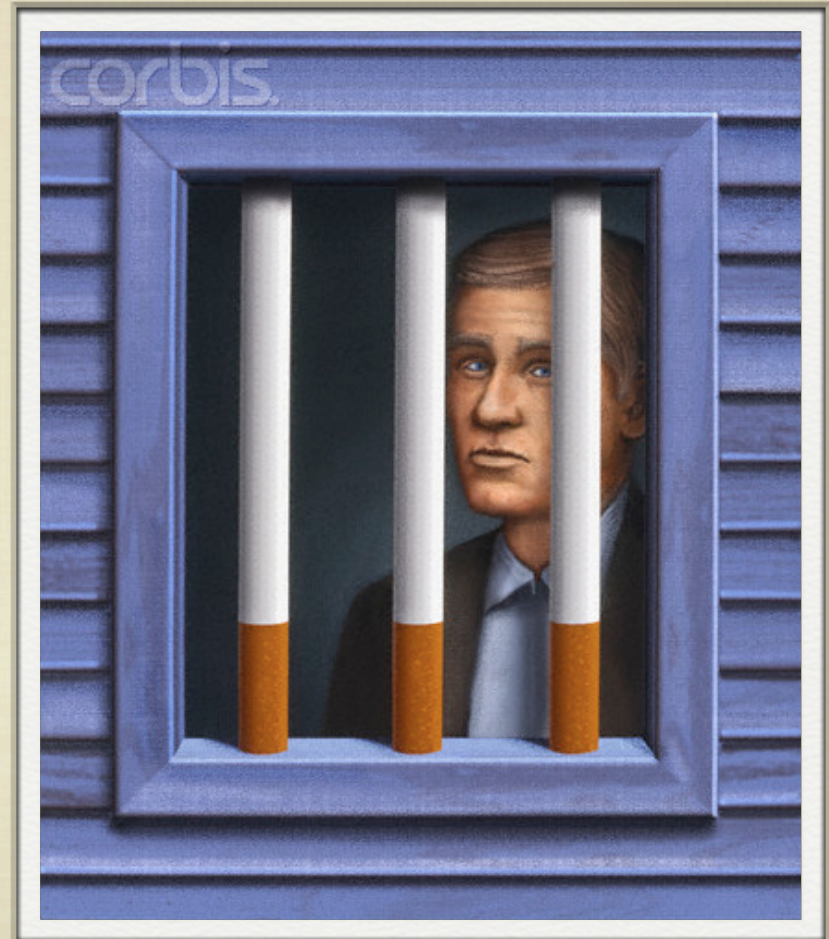
- CAN ADD MULTIPLICITY BEFORE SIGNATURE:

- `m sig A {}`

- EXAMPLE:

- `abstract sig Color {}`
`one sig Red, Yellow, Green`
`extends Color {}`

CREATES AN
ENUMERATION



NEXT TIME

- **FIELDS**

- **TYPES**

- **“PARAGRAPHS”**

- **FACTS, PREDICATES, FUNCTIONS, ASSERTIONS**