CS 186 Discussion #4

Heap Files and Buffers

Logistics

- Homework 2
  - Monday, Sept. 28
  - Finalize partners soon!
- Midterm 1
  - Monday, Oct. 5 (< 2 weeks left!)

Sort-Merge vs. Hash Joins…

Q7: Suppose that there are a few cats with a lot of hats, and many with no hats. Also suppose that our hash functions are "perfect" for our input data (i.e. they distribute keys as uniformly and as randomly as possible). Would it be better to resolve this query with a Hash Join or a Sort-Merge Join? *

You may assume that we are optimizing our sort-merge join.

- ◯ A hash join will be more efficient.
- ◯ It does not matter which join we use.
- ◯ A sort-merge join will be more efficient.

```
SELECT C.cat_id, count(*)
FROM Cats C, Hats H
WHERE C.cat_id = H.cat_id
GROUP BY C.cat_id
```

Hash	201
Sort	149
Doesn't Matter	77

Heap Files

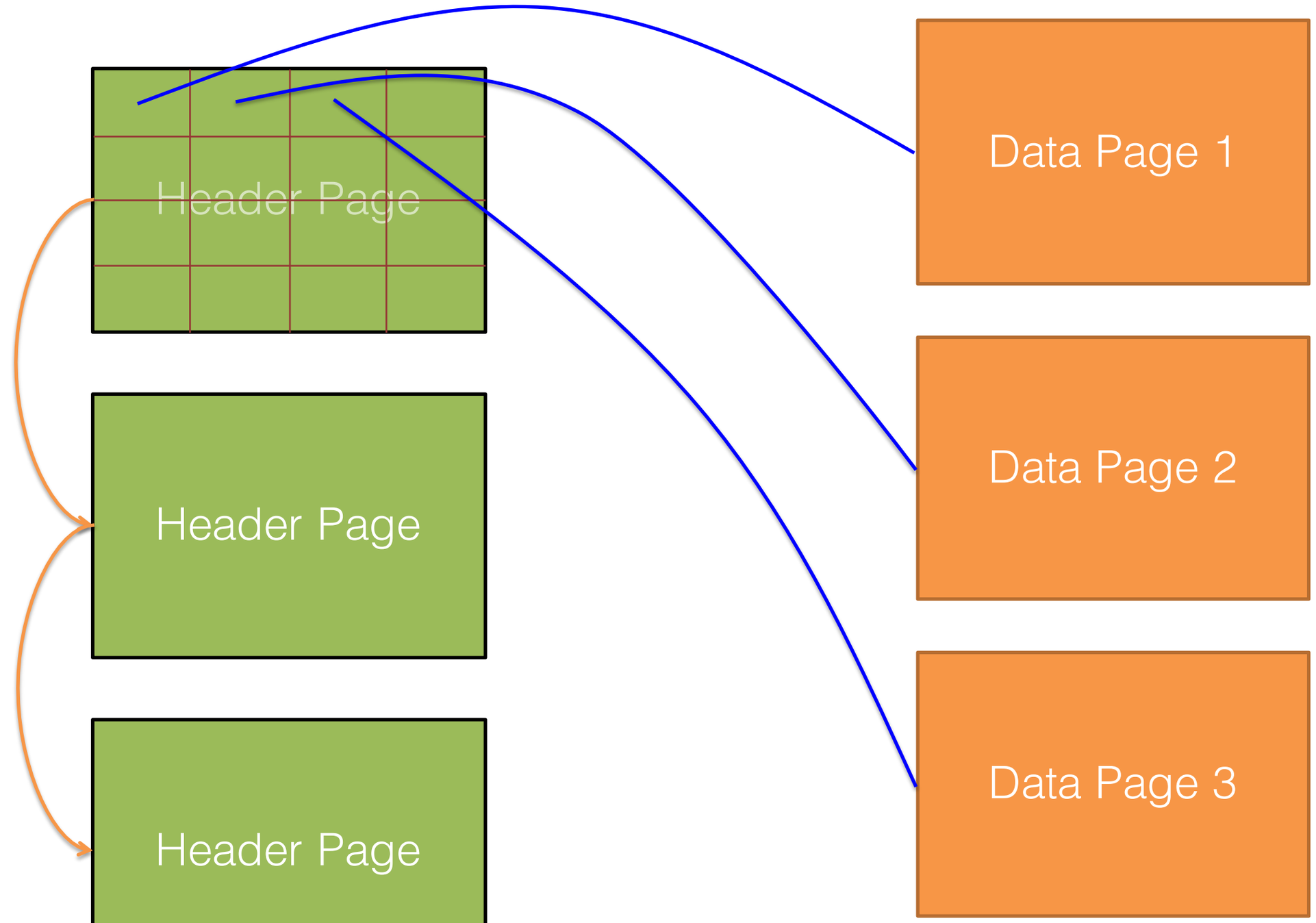
Unordered Files

Heap Files

- Within a heap file, keep track of pages
- Within a page, keep track of records
  - Also keep track of free space

- *RID (Record ID) = <page id, slot #>*

Page Directory

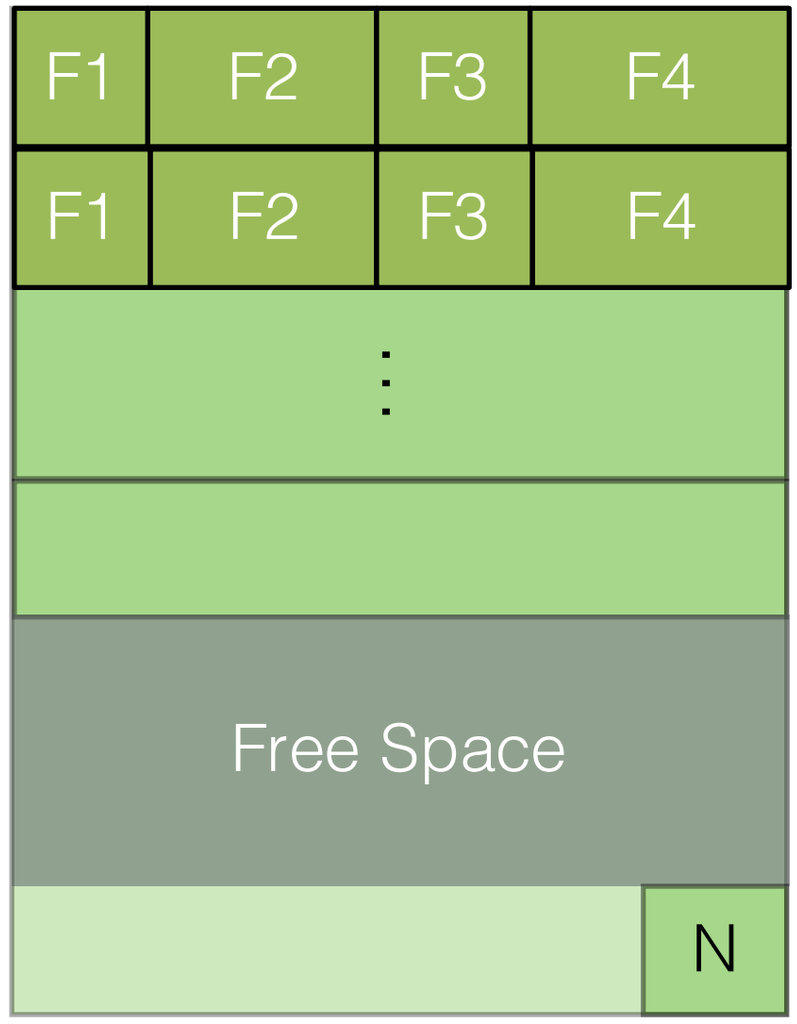


Keep # free bytes on page in directory entries

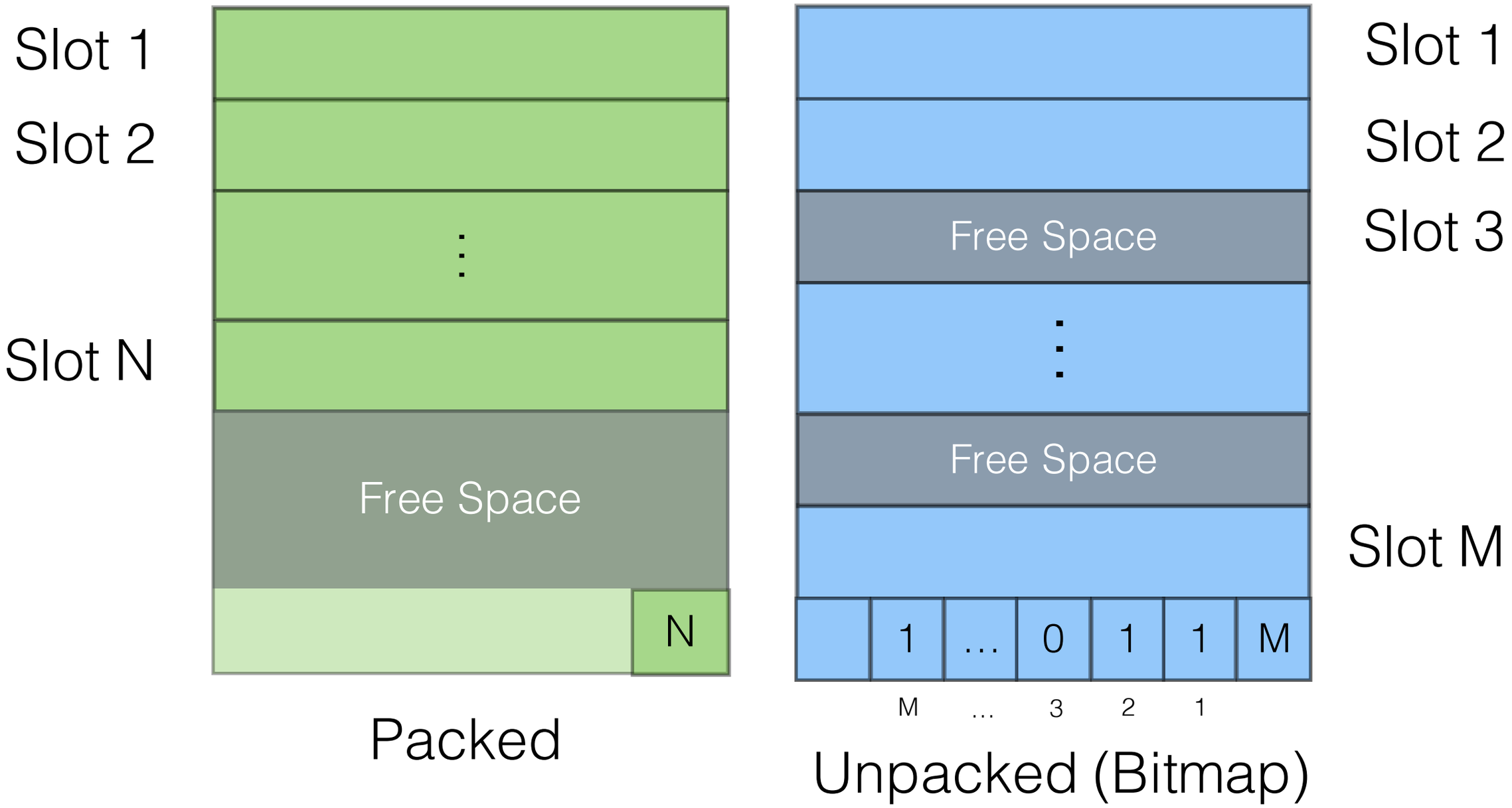
Fixed Length Records

- Fixed record length
- Consistent field length

Keep field type info
in ***system catalog***



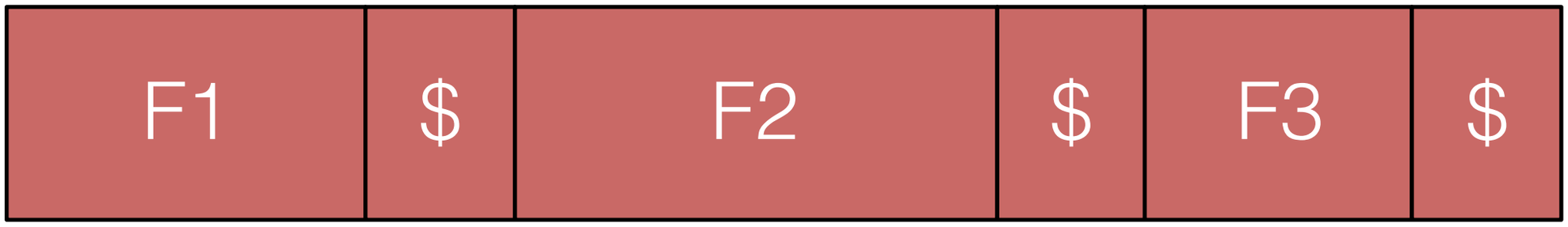
Page Format w/ Fixed-Length Records



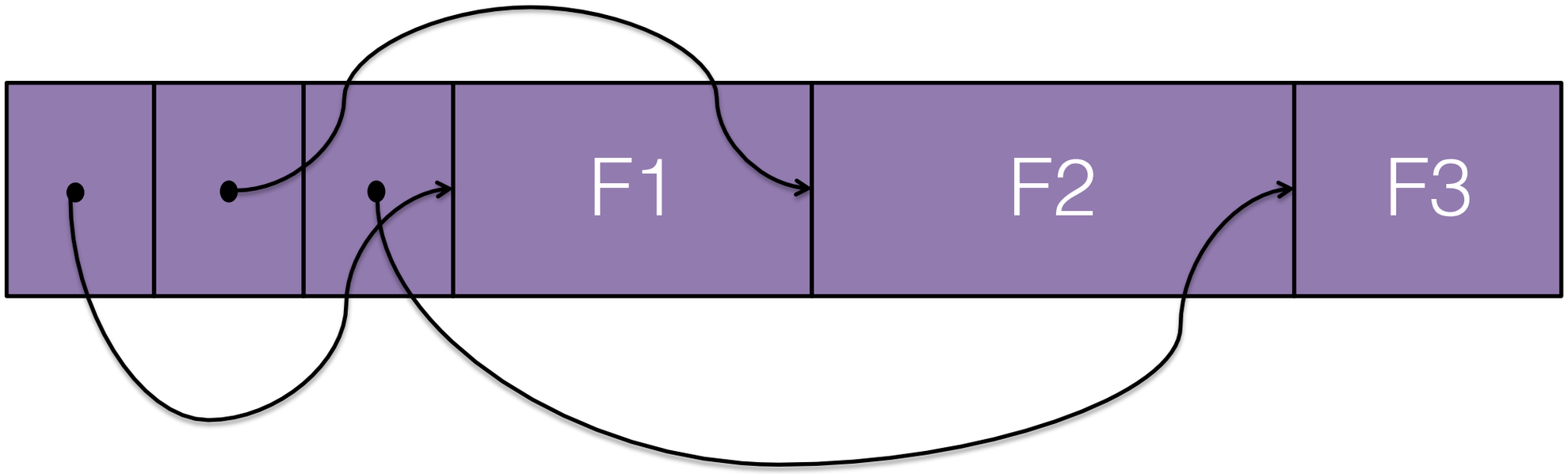
Diagrams by Michelle Nguyen

Variable-Length Records

- Delimit fields with special characters

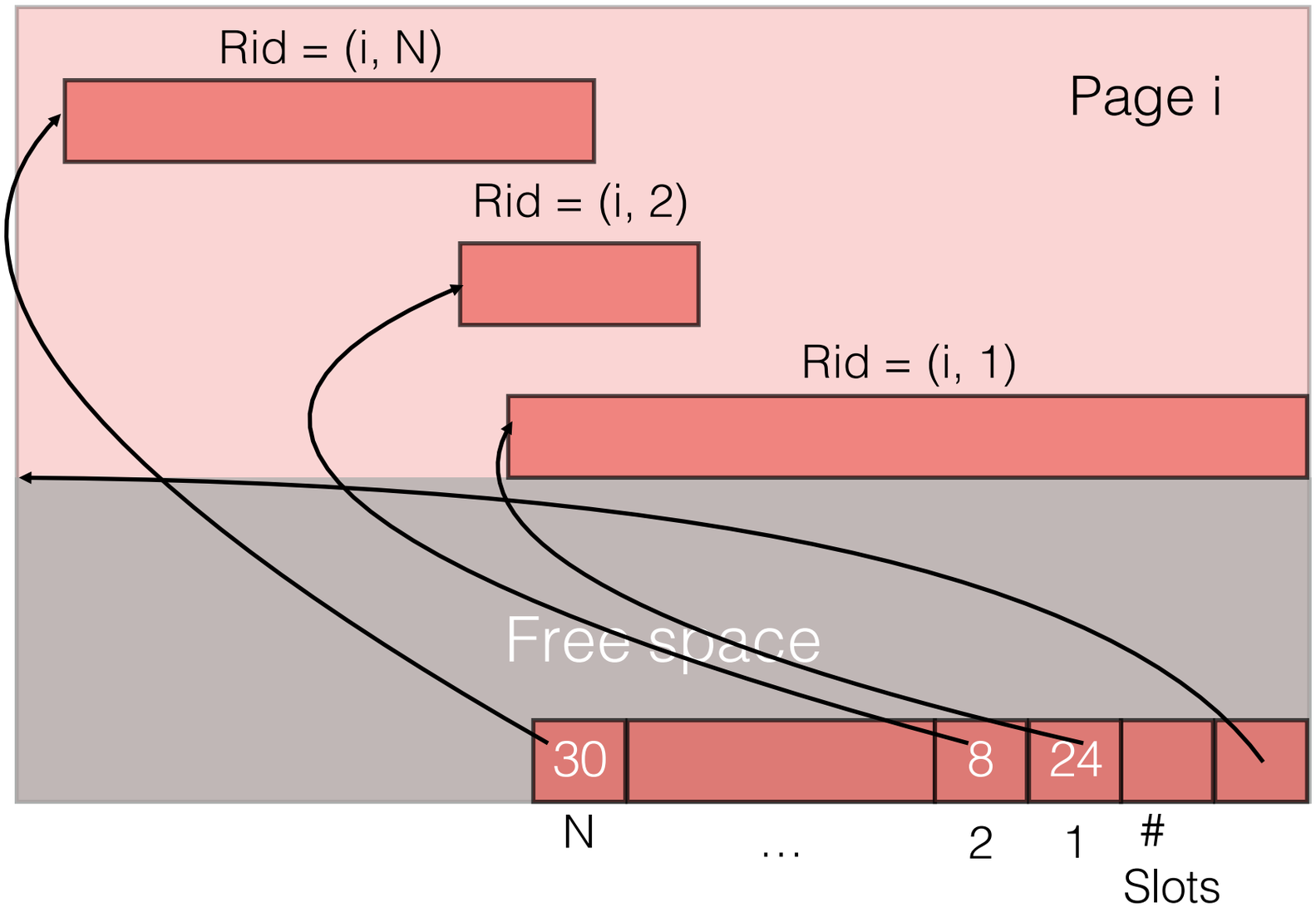


- Array of field offsets



  - Typically preferred choice

Page Format w/ Variable-Length Records



Pointer to start of free space

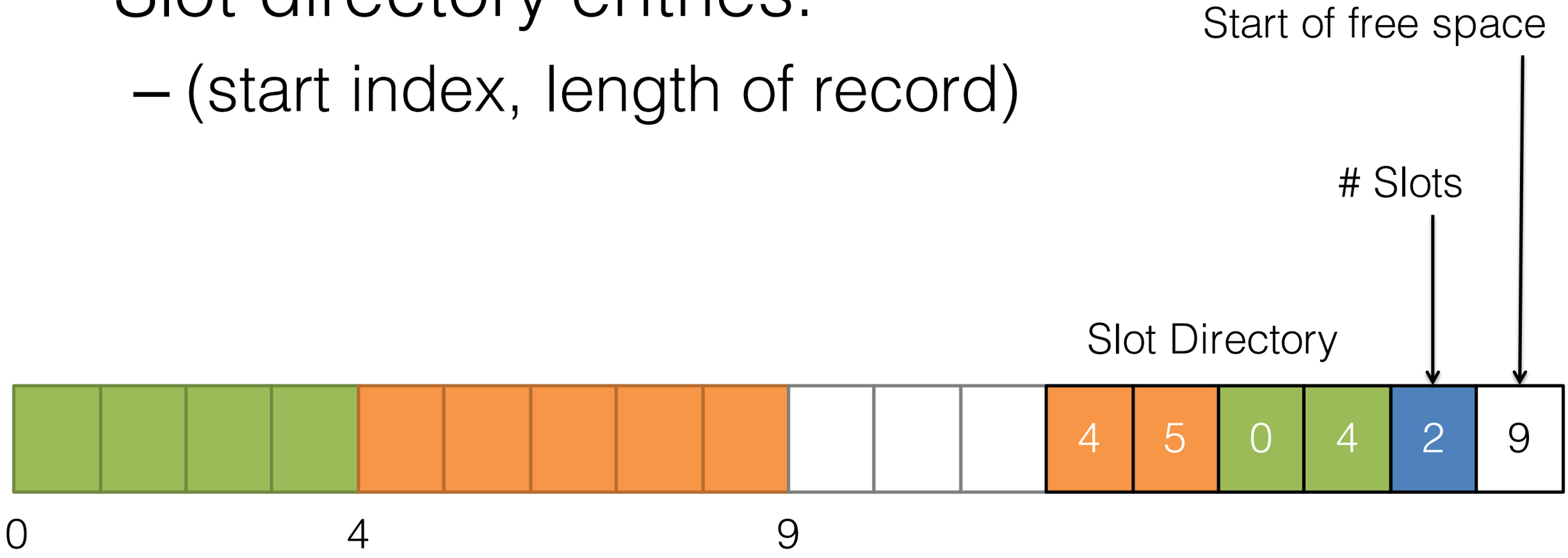
Want to be able to move records around!

Slotted Page

Diagram by Michelle Nguyen

Slotted Page – Detailed View

- Slot directory entries:
  - (start index, length of record)



Buffers

Buffers

- General information:

  <frame #, page_id, pin_count, dirty>

  – Only replace frame if pin_count == 0

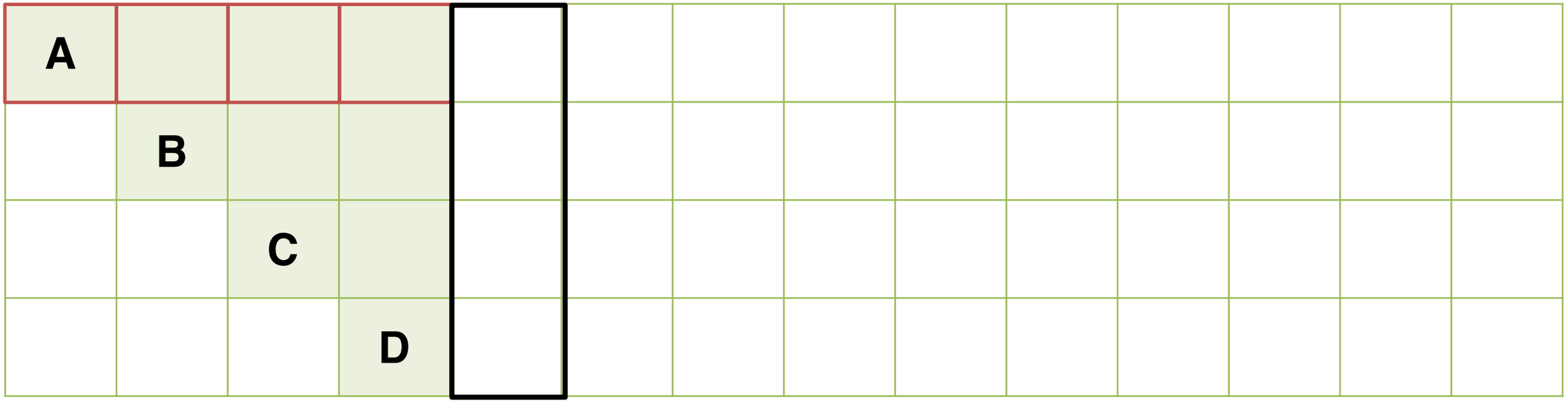
  – Write to disk if dirty bit is on

“Clock” Replacement Policy

- *Approximation* of LRU
- Store reference bit instead of last access time for page frames
- When pin_count drops to 0,
  - Flip reference bit on
- If clock hand reaches an “on” ref.
  - Flip reference bit off
- If clock hand reaches an “off” ref.
  - Replace page

Worksheet – Clock Policy

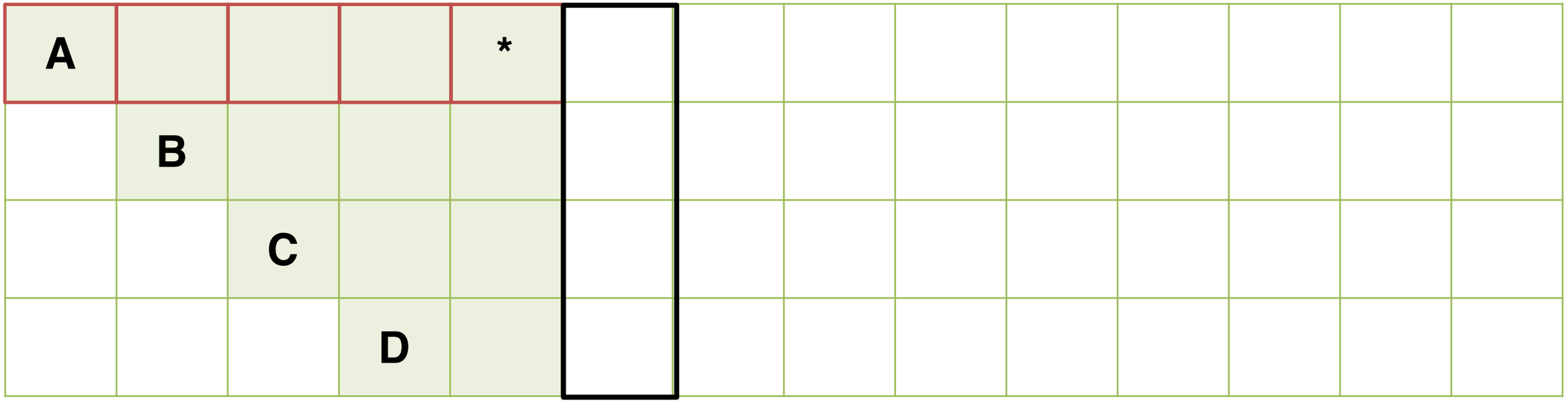
Just read A, B, C, D



Now request A

Worksheet – Clock Policy

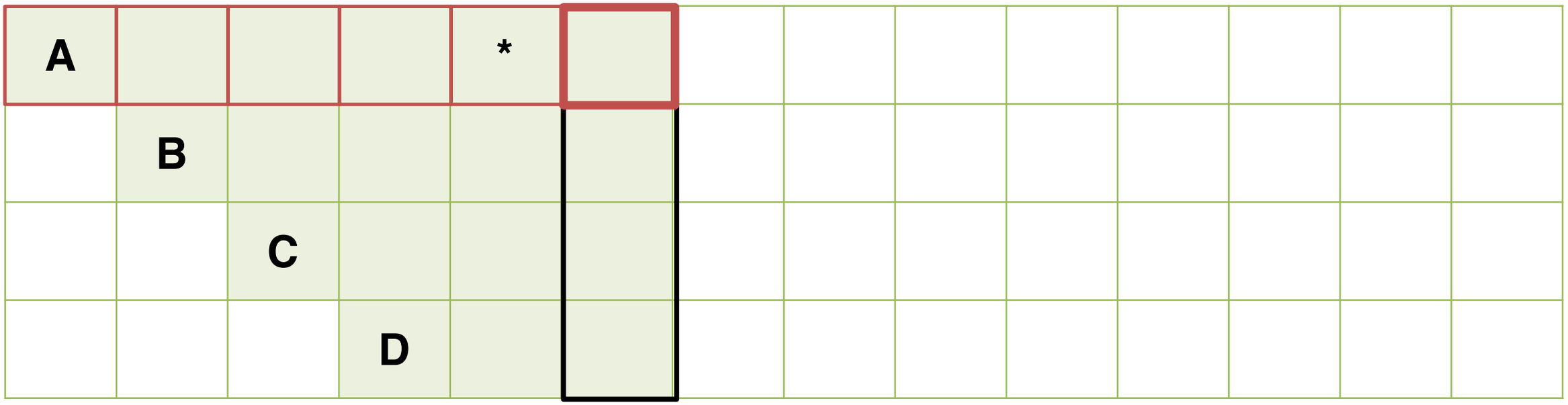
Just requested A



Now request F

Worksheet – Clock Policy

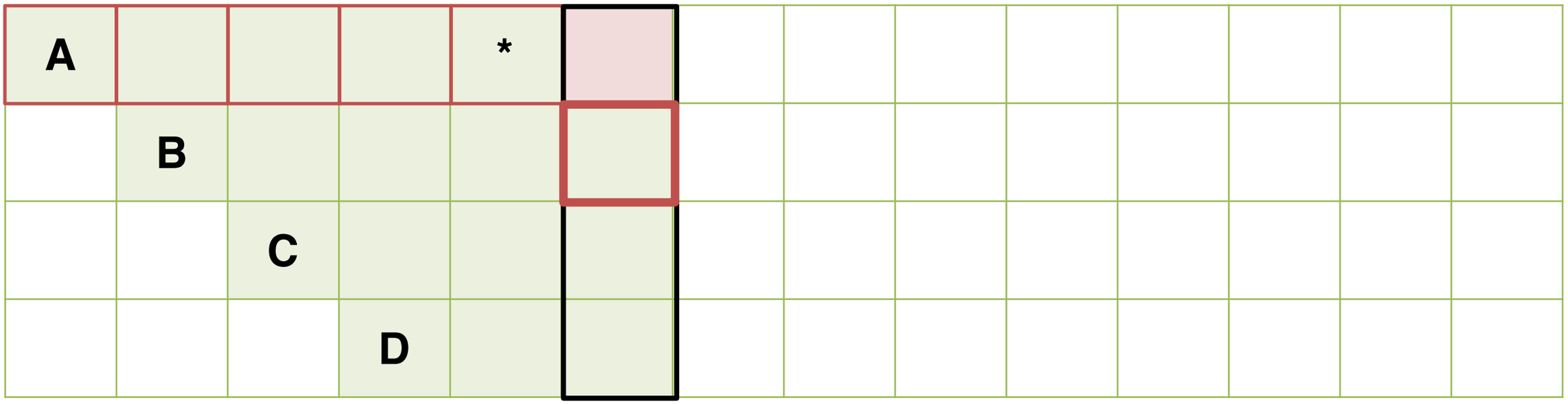
Just requested A



Now request F

Worksheet – Clock Policy

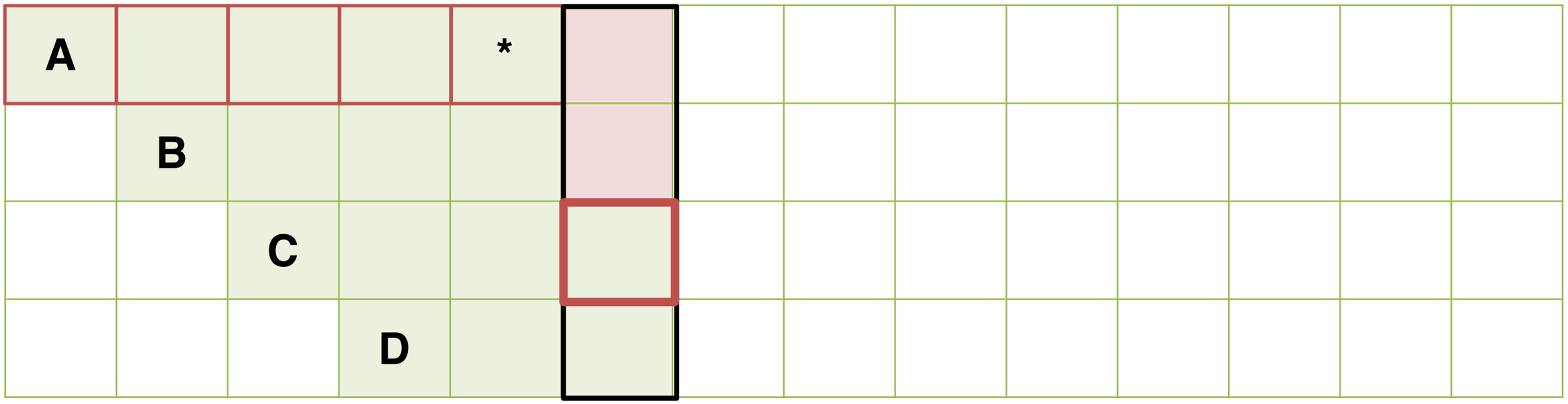
Just requested A



Now request F

Worksheet – Clock Policy

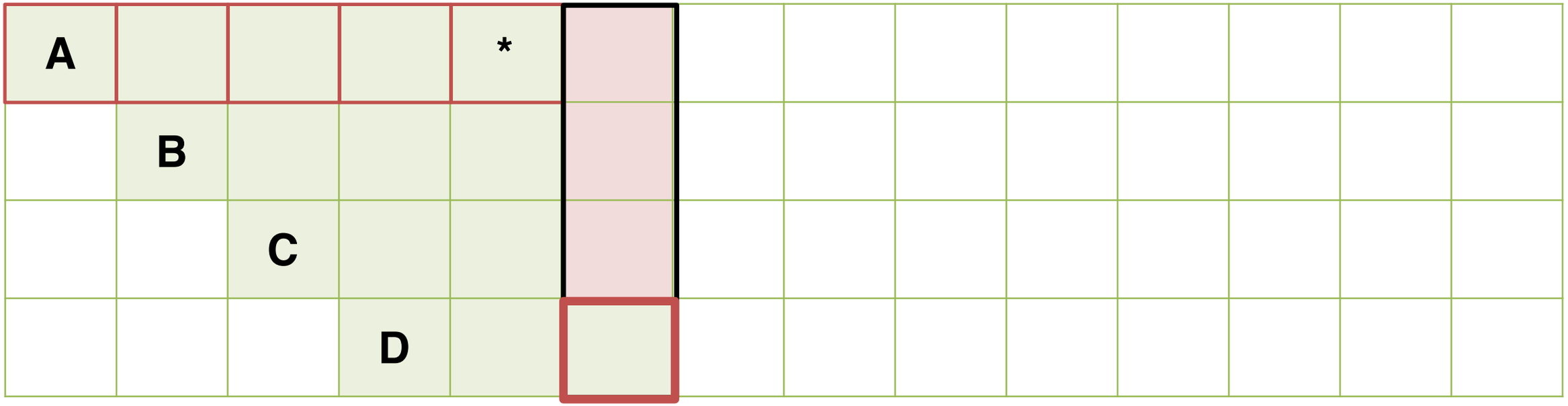
Just requested A



Now request F

Worksheet – Clock Policy

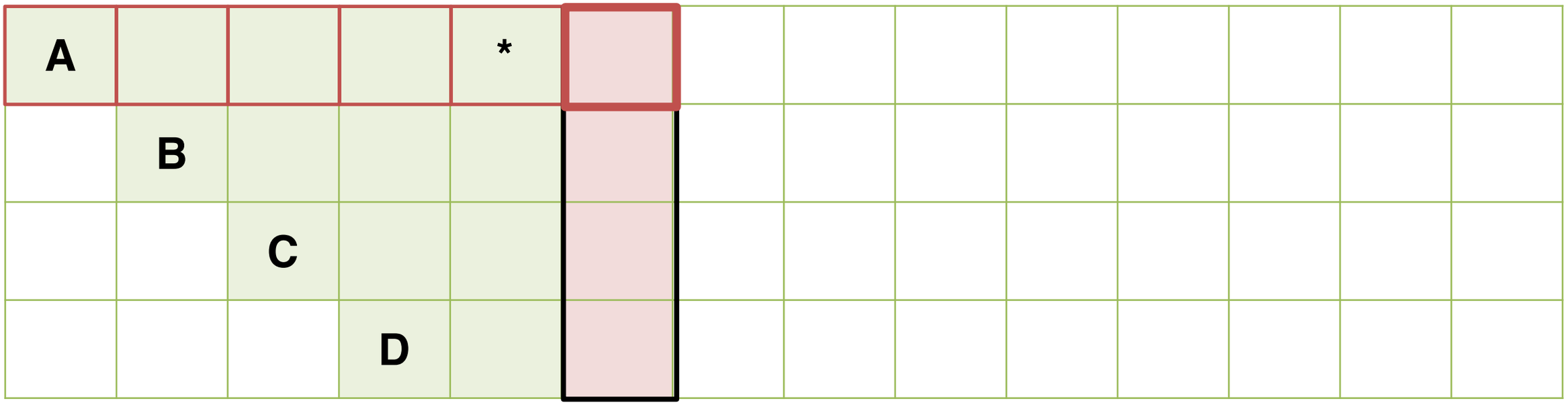
Just requested A



Now request F

Worksheet – Clock Policy

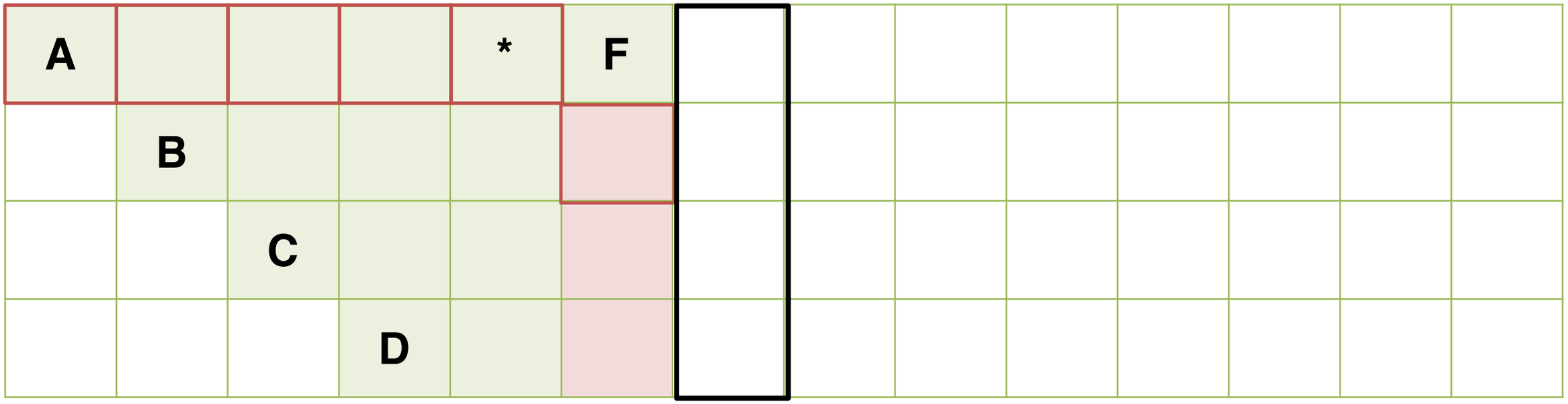
Just requested A



Now request F

Worksheet – Clock Policy

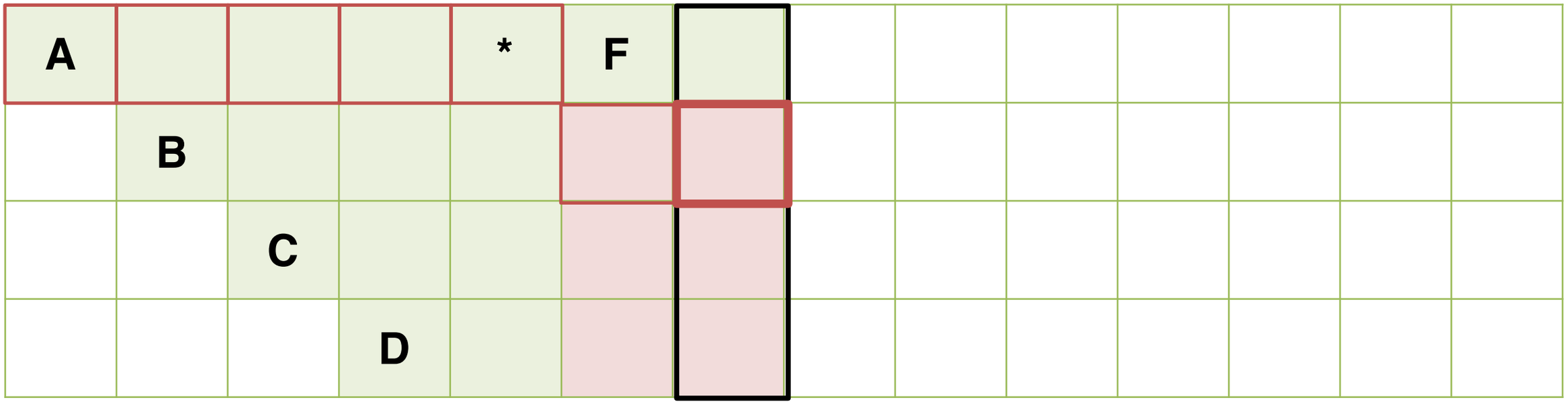
Just requested F



Now request A

Worksheet – Clock Policy

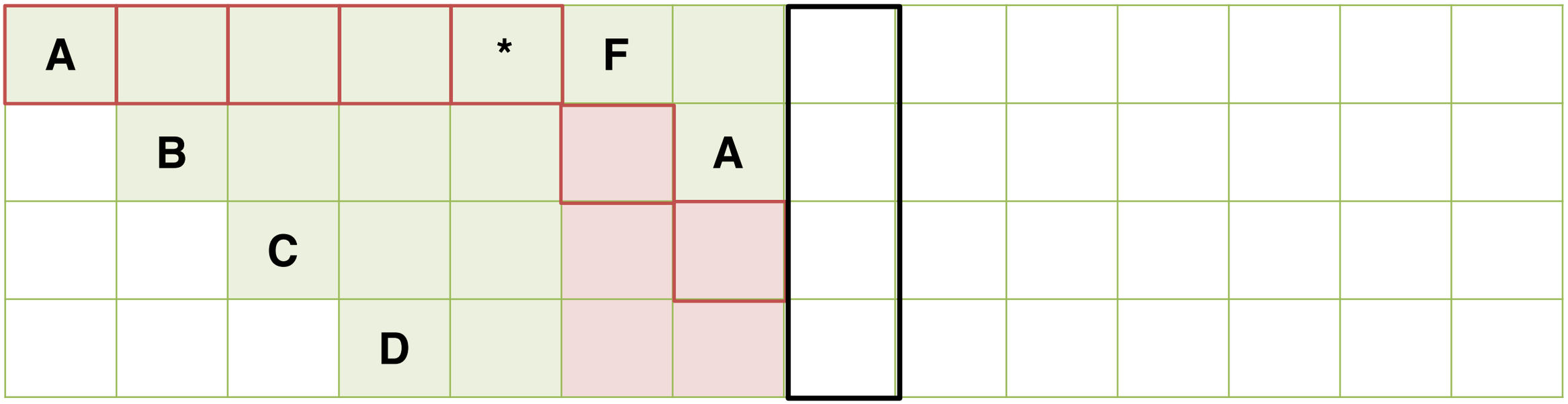
Just requested F



Now request A

Worksheet – Clock Policy

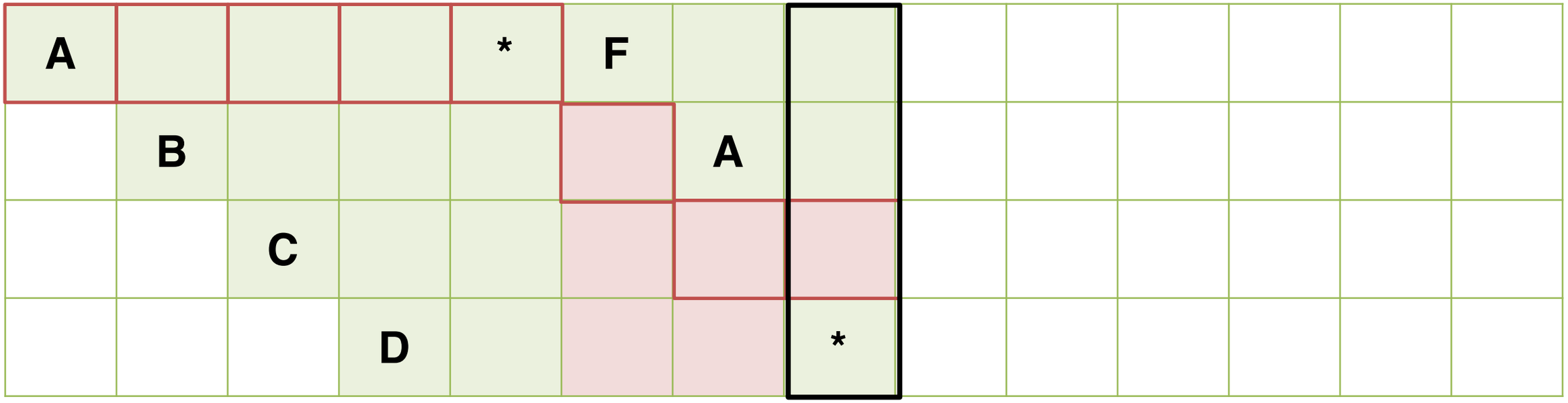
Just requested A



Now request D

Worksheet – Clock Policy

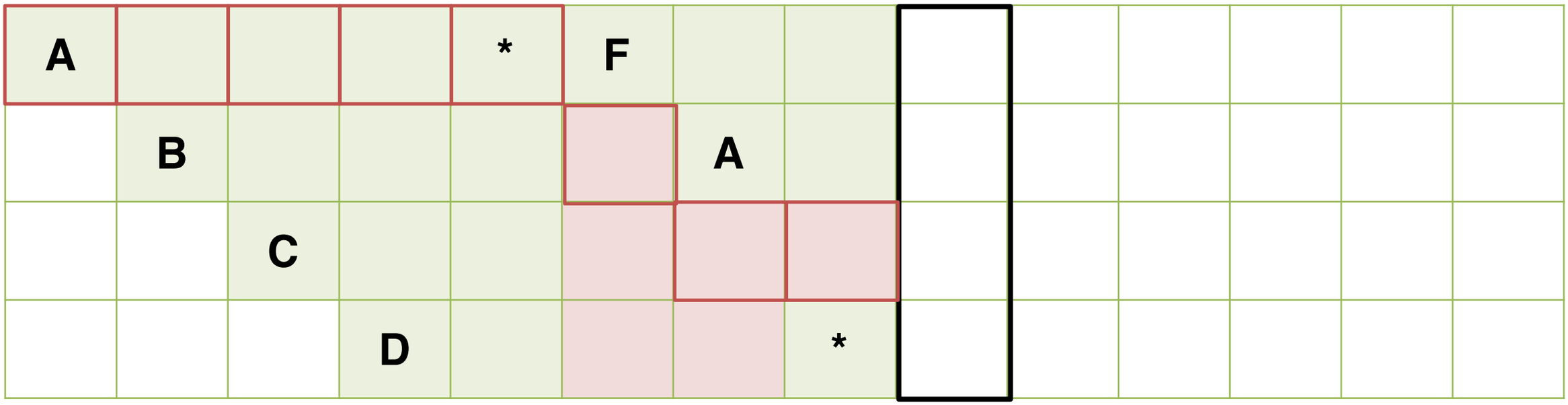
Just requested A



Now request D

Worksheet – Clock Policy

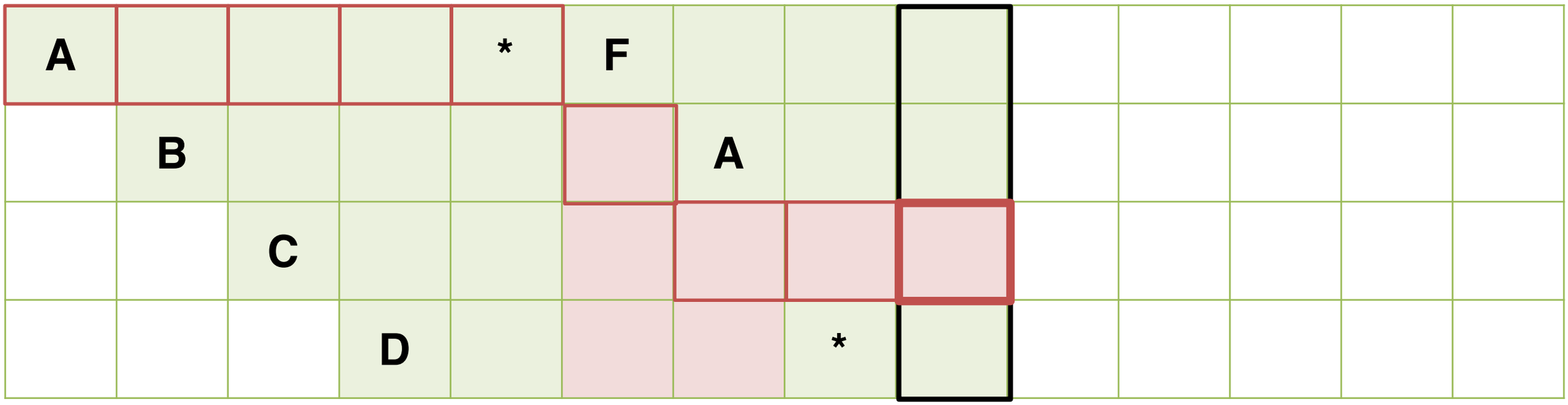
Just requested D



Now request G

Worksheet – Clock Policy

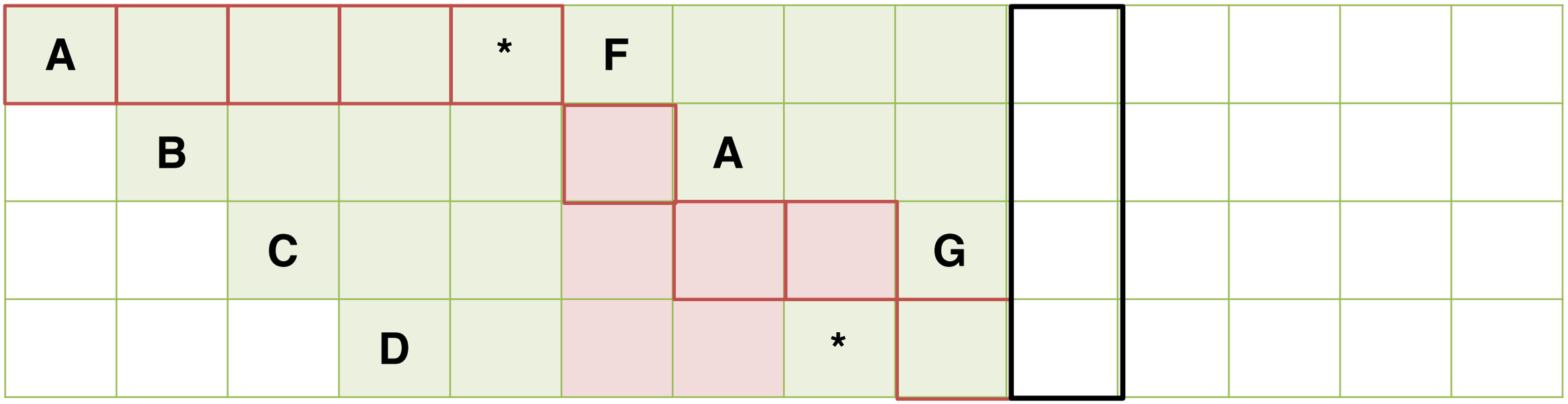
Just requested D



Now request G

Worksheet – Clock Policy

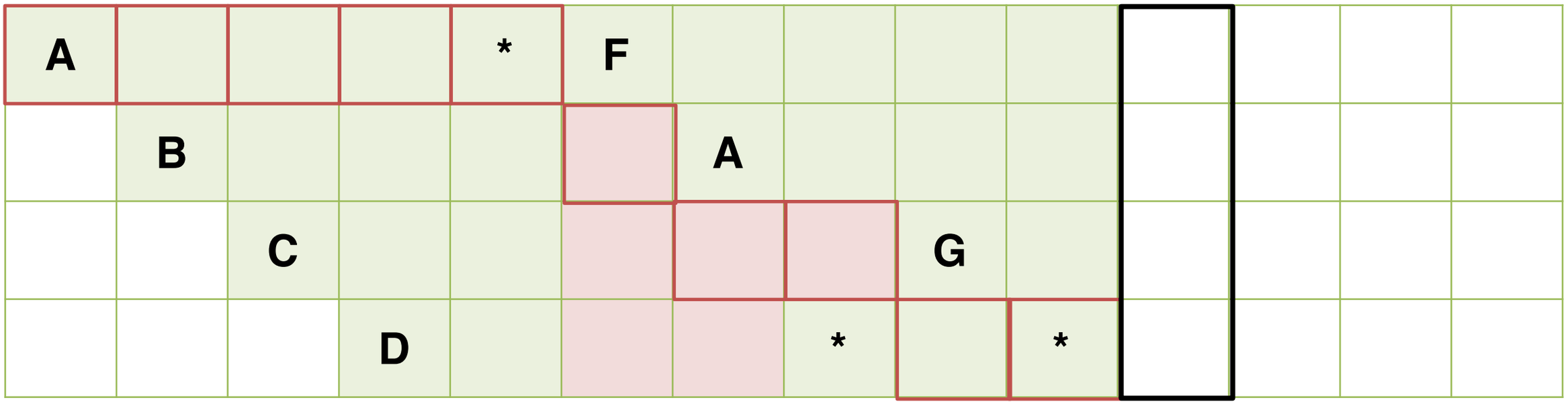
Just requested G



Now request D

Worksheet – Clock Policy

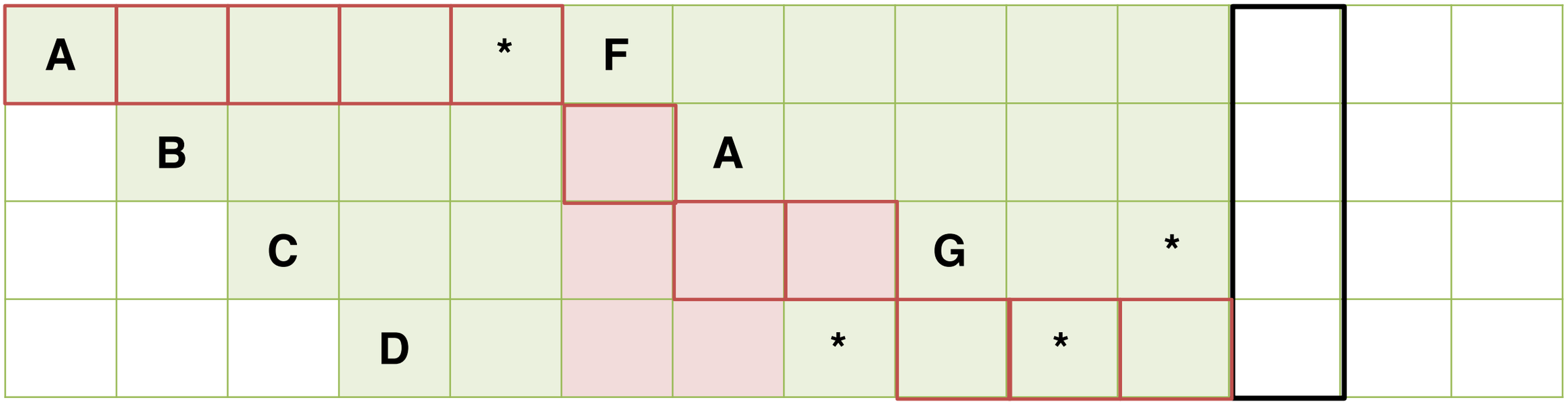
Just requested D



Now request G

Worksheet – Clock Policy

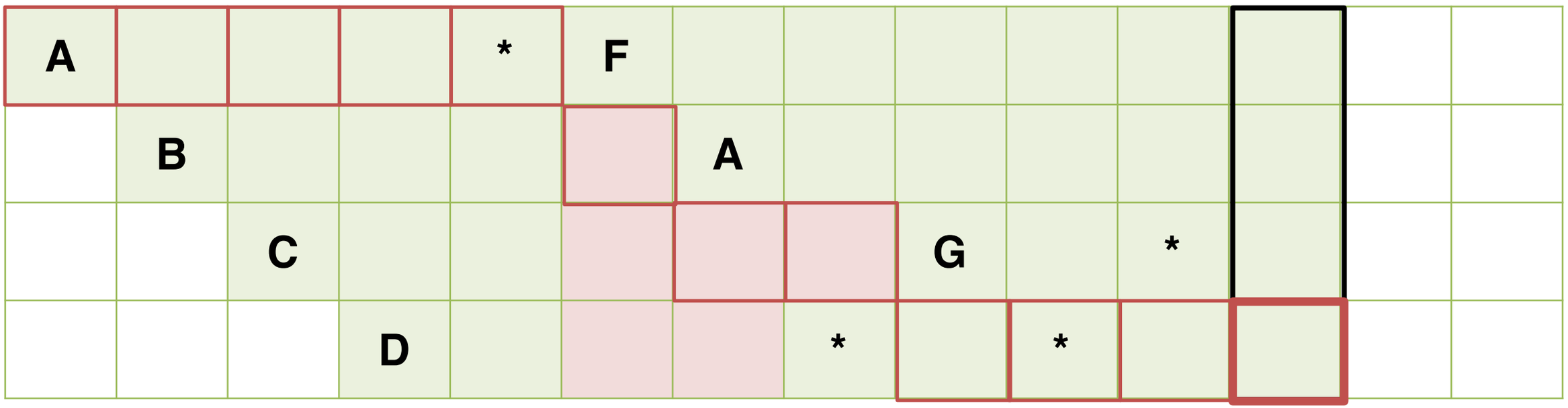
Just requested G



Now request E

Worksheet – Clock Policy

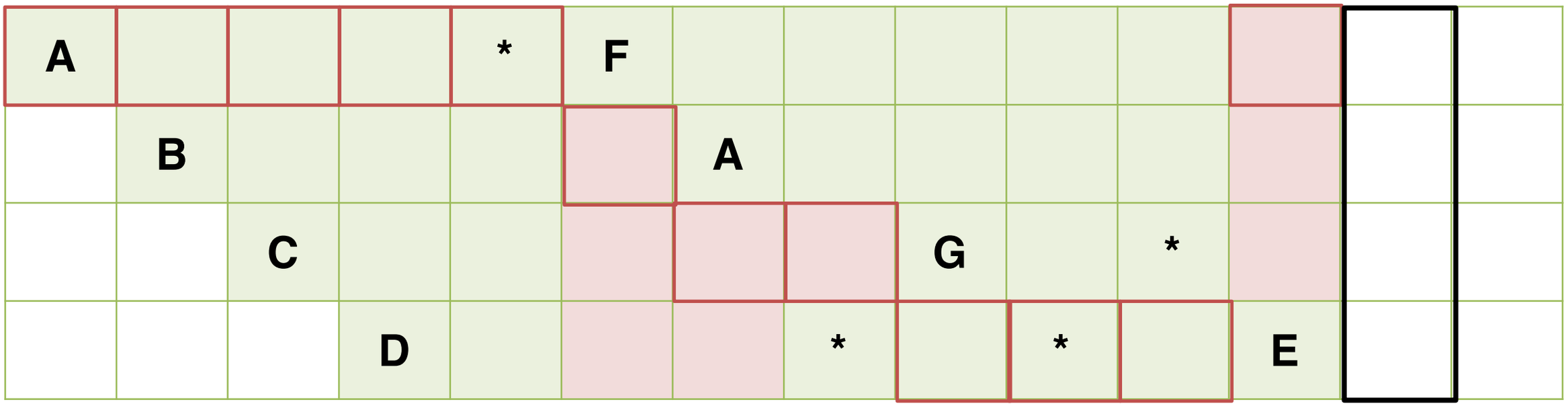
Just requested G



Now request E

Worksheet – Clock Policy

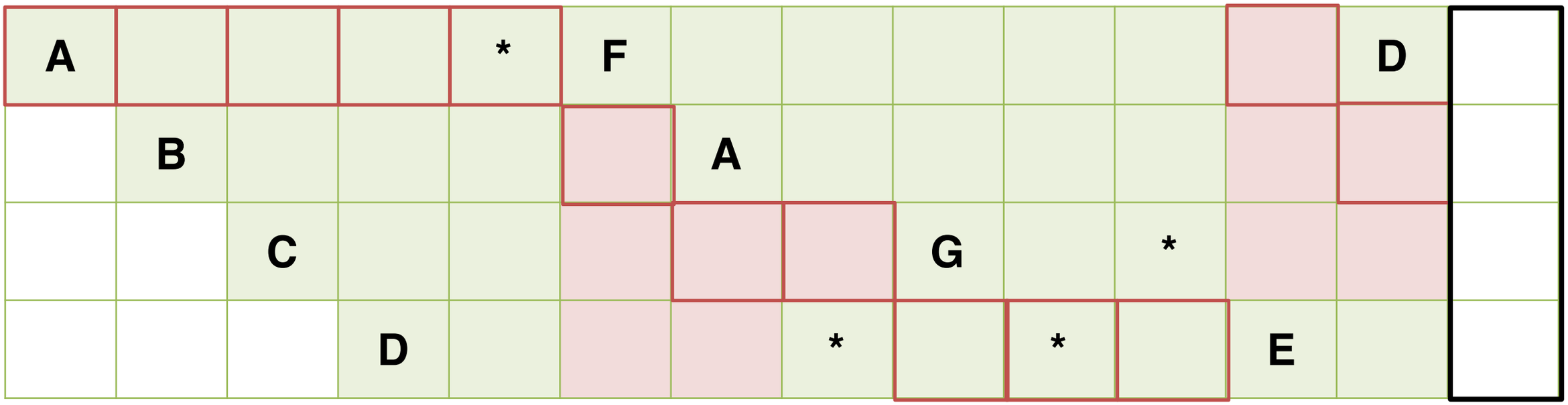
Just requested E



Now request D

Worksheet – Clock Policy

Just requested D



Now request F

Worksheet – Clock Policy

Just requested F

A				*	F							D	
	B					A							F
		C						G		*			
			D				*		*		E		