“Unplugged” Flagmaker Activity

Activity idea

You'll be pretending to be the computer drawing the flag of Mauritius:

Img from: https://en.wikipedia.org/wiki/Mauritius

You'll use paper and markers, but otherwise follow how a computer might draw it:

- Color one cell at at a time
  - Fill in the squares thoroughly (but quickly)

How to color

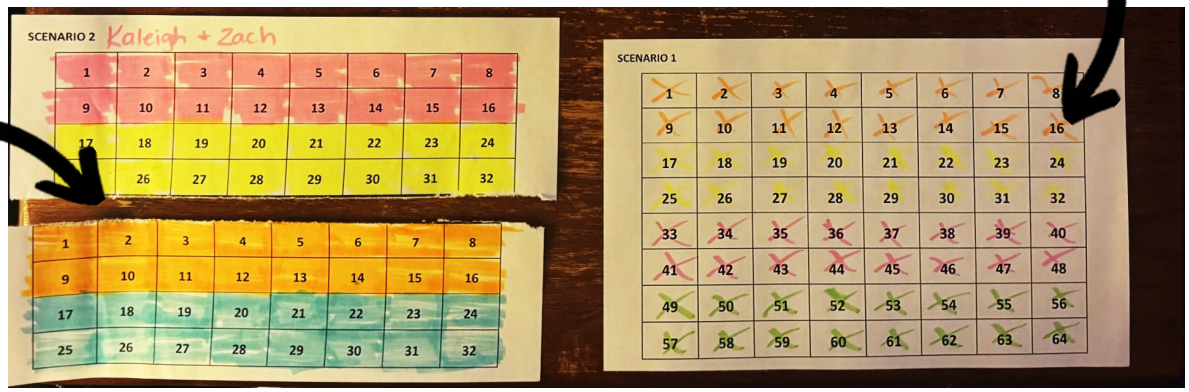
You must **color one square at a time**.

Do not color in multiple squares at one time.

CORRECT!

WRONG!

Fill in the squares



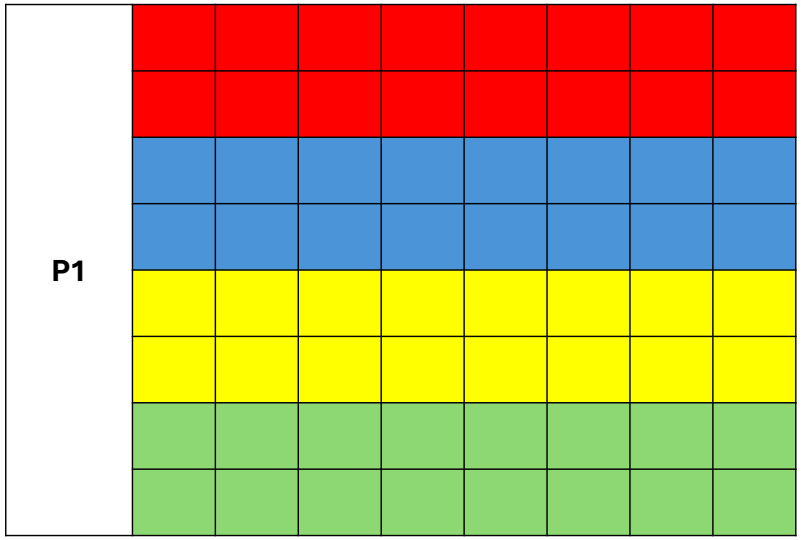
WRONG!

Don't tear the paper!

Scenario 1: Single processor

Two people:

1. The Processor: colors first stripe (cell by cell), second stripe (cell by cell), third stripe (cell by cell), and then fourth stripe (cell by cell)
2. Timer: Times the Processor



Scenario 2: Two processors collaborating

Now 2 processors each help draw

Three people:

1. Processor 1: Colors red and blue stripes (cell by cell)
2. Processor 2: Colors yellow and green stripes (cell by cell)
3. Timer: Times them; stop when **all** cells are colored

P1	1	2	3	4	5	6	7	8
	9	10	11	12	13	14	15	16
	17	18	19	20	21	22	23	24
	25	26	27	28	29	30	31	32
P2	1	2	3	4	5	6	7	8
	9	10	11	12	13	14	15	16
	17	18	19	20	21	22	23	24
	25	26	27	28	29	30	31	32

Scenario 3: Four processors collaborating

Five people:

1-4. Processors: Each assigned to one color, which they color (cell by cell)

5. Timer: Again, stop when **all** cells are colored

P1	1	2	3	4	5	6	7	8
	9	10	11	12	13	14	15	16
P2	1	2	3	4	5	6	7	8
	9	10	11	12	13	14	15	16
P3	1	2	3	4	5	6	7	8
	9	10	11	12	13	14	15	16
P4	1	2	3	4	5	6	7	8
	9	10	11	12	13	14	15	16

Scenario 4: Four processors collaborating a different way

1-4. Processors: Each assigned a strip of two columns (first takes left 2 columns, second takes next two columns, etc). Colors these cell by cell

5. Timer: Same as before

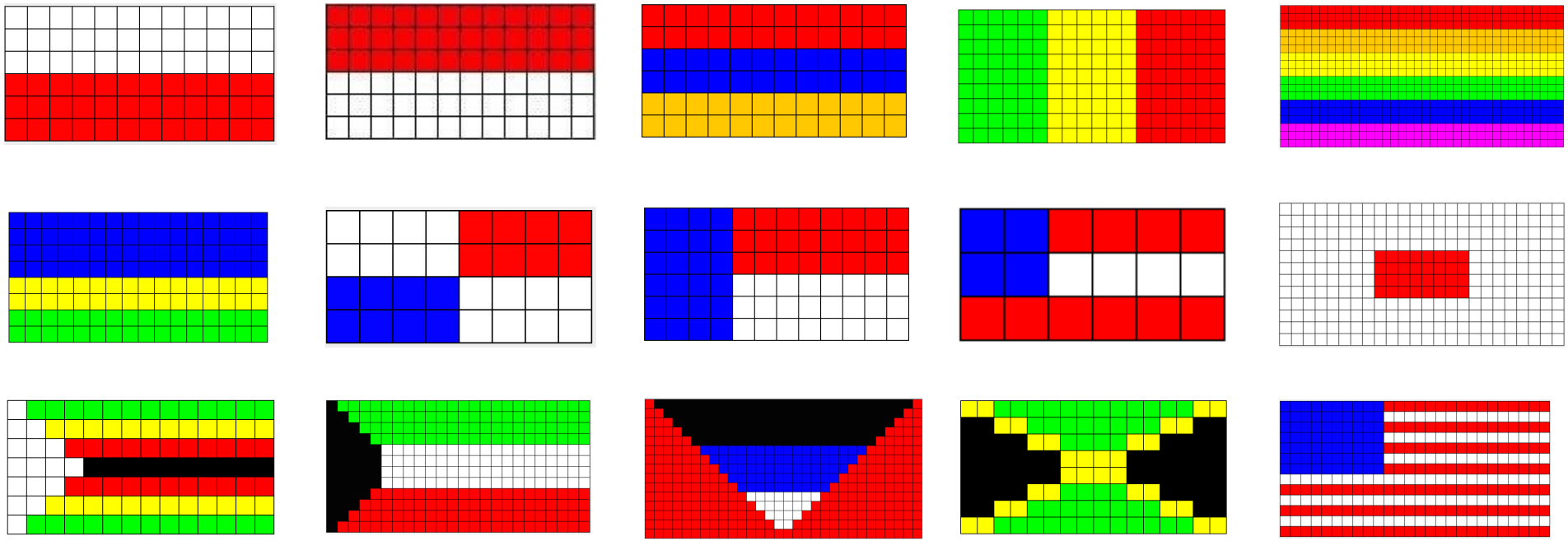
P1		P2		P3		P4	
1	9	1	9	1	9	1	9
2	10	2	10	2	10	2	10
3	11	3	11	3	11	3	11
4	12	4	12	4	12	4	12
5	13	5	13	5	13	5	13
6	14	6	14	6	14	6	14
7	15	7	15	7	15	7	15
8	16	8	16	8	16	8	16

Post-activity discussion

Post-activity discussion

- Speedup
- Warm up
- Technology differences
- Contention
- Pipelining

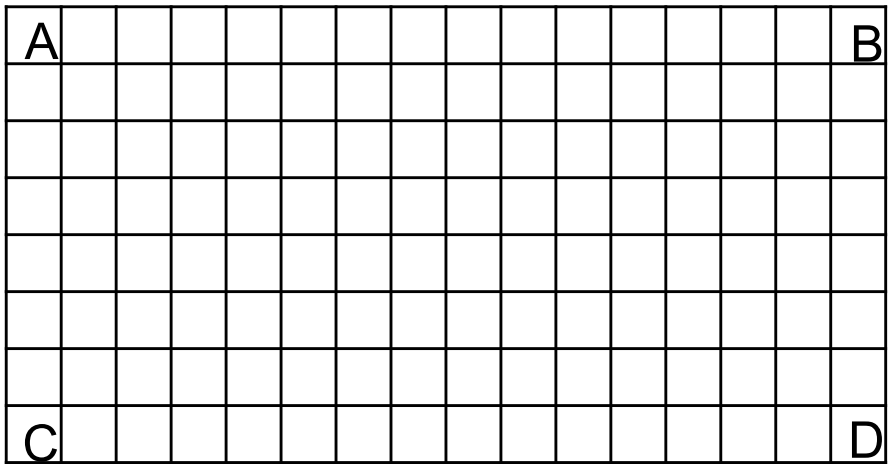
Programming activity: Teach loops with flag drawing!



Java application with methods they fill in to draw each flag
Has support for debugging, grading, and changing the flags

What is the first cell that this code colors?

```
int rows = g.getNumRows();
int cols = g.getNumCols();
for(int i=0; i<rows; i++) {
    for(int j=0; j<cols; j++) {
        g.setColor(i, j, Color.RED);
     }
}
```



E: None of the above

What is the first cell that this code colors?

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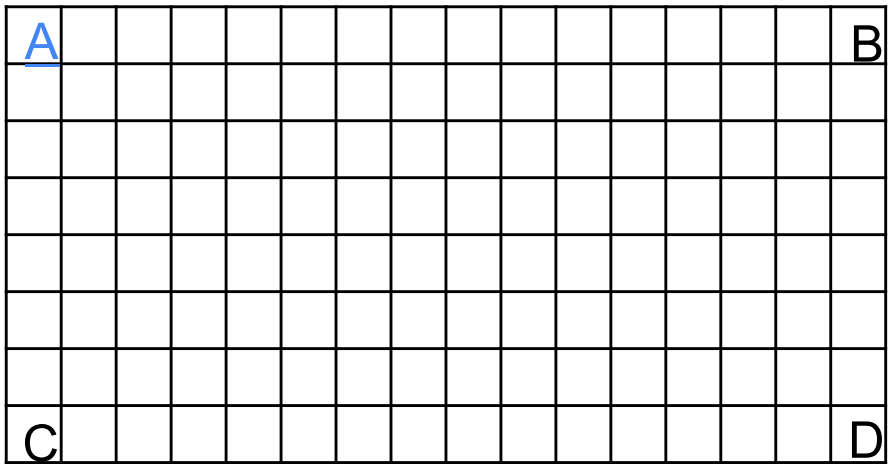
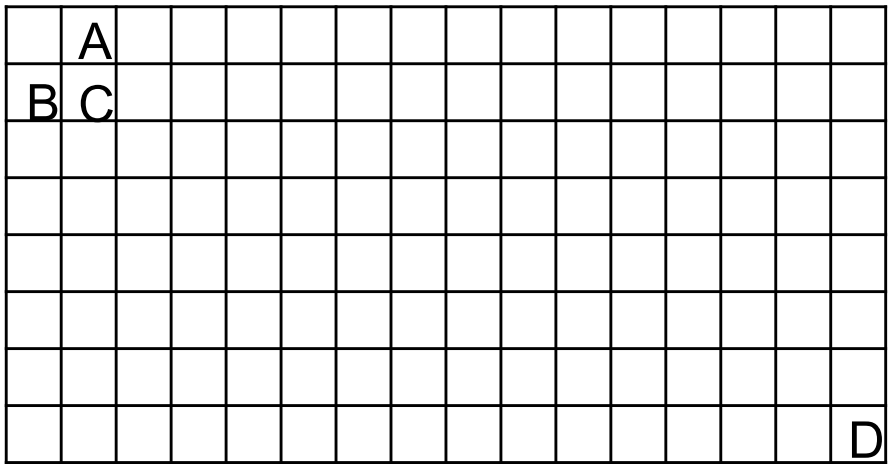


E: None of the above

What is the second cell that this code colors?

```
int rows = g.getNumRows();
int cols = g.getNumCols();
for(int i=0; i<rows; i++) {
    for(int j=0; j<cols; j++) {
        g.setColor(i, j, Color.RED);
     }
}
```



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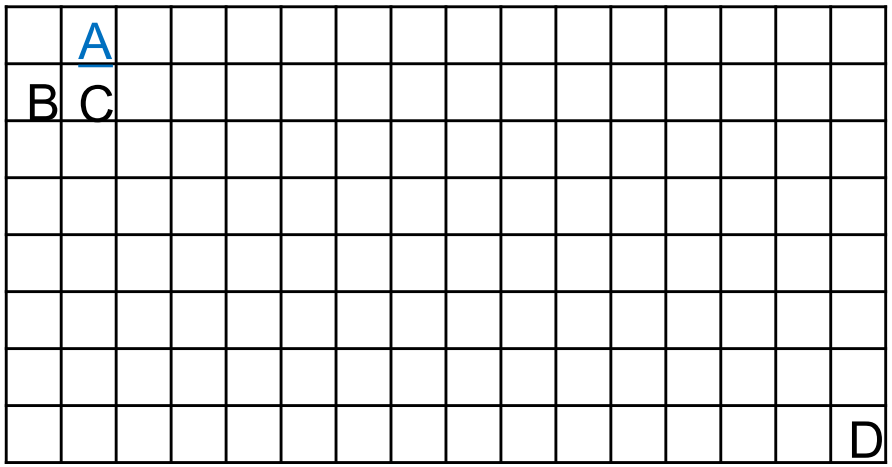
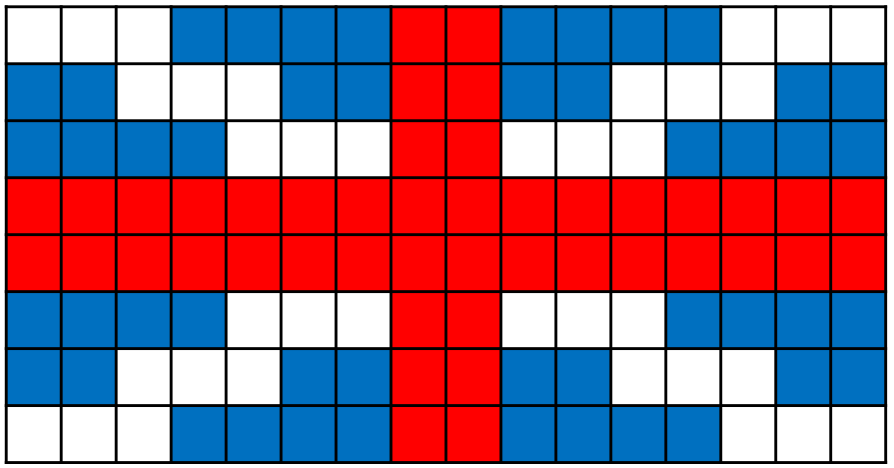


E: None of the above

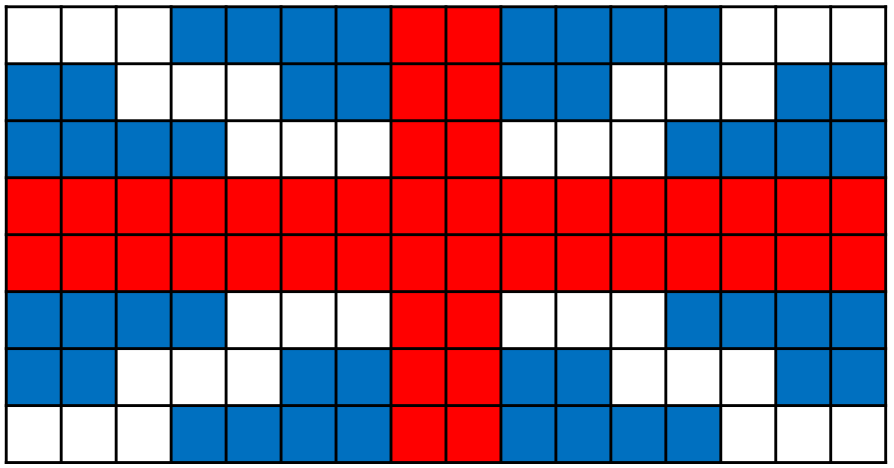
How would you draw the British flag?



https://en.wikipedia.org/wiki/Flag_of_Great_Britain#/media/File:Flag_of_Great_Britain_(1707%E2%80%931800).svg

One strategy: Drawing “layers”

- Color entire background blue
- Draw white diagonals
- Draw vertical and horizontal red lines



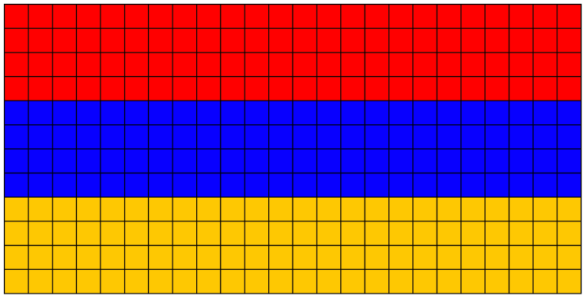
Parallel computation

(concept only now, do in later courses)

- Modern computers are all multicore (dual-core, quad-core, …) so they can perform multiple operations at a time

- Potentially speeds up some tasks, like drawing the Armenian flag

  Simultaneously do these tasks:
  - Draw red stripe
  - Draw blue stripe
  - Draw yellow stripe



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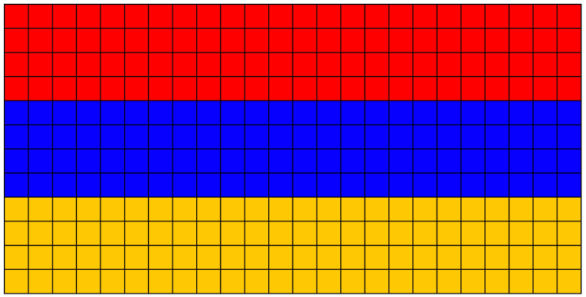
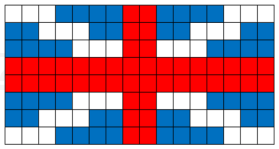
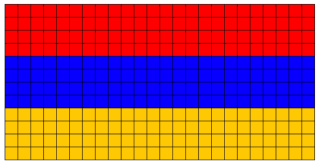


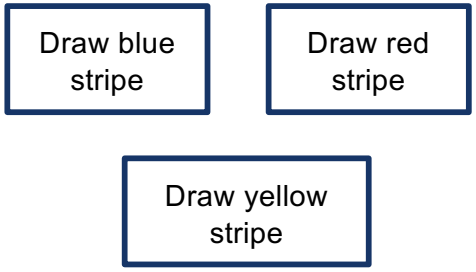
Can we do this with the British flag?

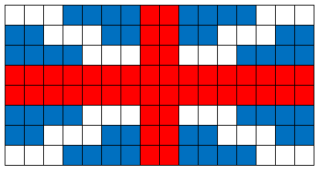


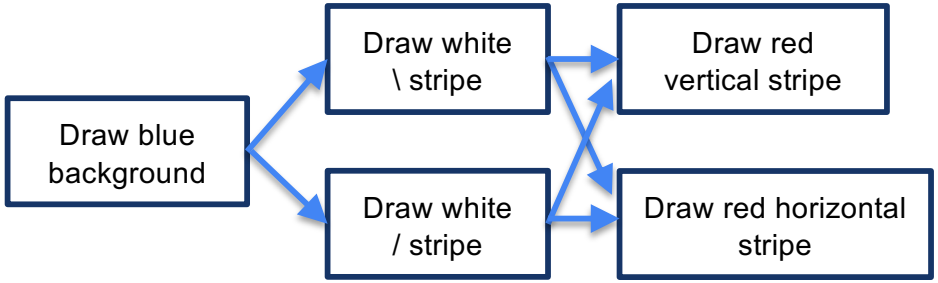
“Task Graph”

- Diagram of dependencies (when one thing must come before another)
  - For flags: when operations would color a tile different colors
  - Draw arrows to show which must come before others

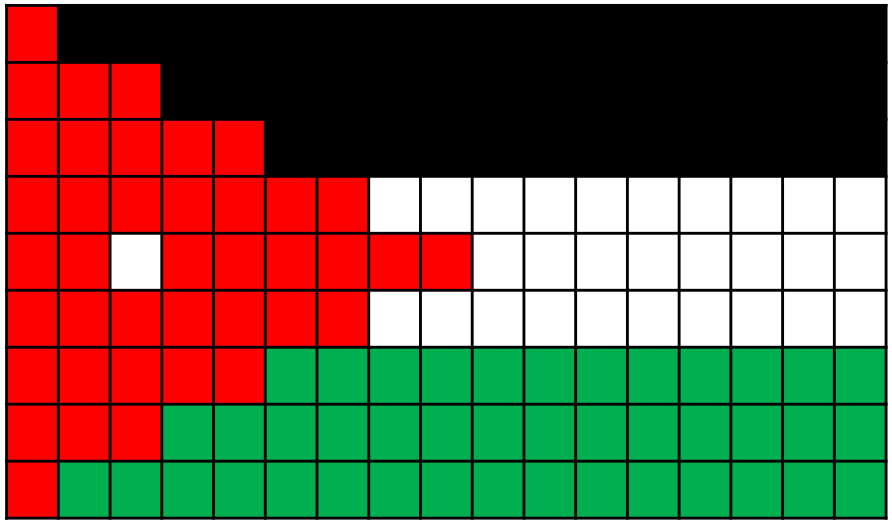








Create a task graph to draw the flag of Jordan



https://upload.wikimedia.org/wikipedia/commons/c/c0/Flag_of_Jordan.svg