Parallel Threads

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1 Exercise 1.

```
class Algo1:
  halt = 0
  x = 0

  def t1(self):
    a = self.x
    a = a + 5
    self.x = a

  def t2(self):
    b = self.x
    b = b + 10
    self.x = b
```

This is possible by `t1` → `t2` → `t2` → `t2` → `t1` → `t1`.
This is the rightmost node at the graph shown in `1.html`

2 Exercise 2.

```
class Algo2:
    halt = 0
    x = 5
    y = 10
    z = 30
    sum = 0

    def t1(self):
      val1 = self.sum + self.x
      self.sum = val1

    def t2(self):
      val1 = self.sum + self.y
      self.sum = val1

    def t3(self):
      val1 = self.sum + self.z
      self.sum = val1
```

Part 1. This is possible by `t2` → `t3` → `t3` → `t2` → `t1` → `t1`, which got the sum 15.

Part 2. This is possible by `t2` → `t3` → `t1` → `t1` → `t2` → `t3`
This is verified by states on `2.html`.

3 Exercise 3.

```
class Algo3:
  halt = 0
  turn = ''
  x = 0

  def t1(self):
    self.turn = 't1'
    while self.turn == 't2':
      pass
    a = self.x
    a = a + 5
    self.x = a
    self.turn = 't2'

  def t2(self):
    self.turn = 't2'
    while self.turn == 't1':
      pass
    b = self.x
    b = b + 10
    self.x = b
    self.turn = 't1'
```

One possible path is `t2` → `t2` → `t1` → `t1` → `t1` → `t1` → `t2` → `t2` → `t1` → `t2` → `1` → `2`
This is verified by states on `3.html`. As red nodes on `3-marked.html` shows the problem in critical section(marked by CS).
Using Peterson algorithm can make sure the addition is atomic.

4 Note

The model-checker is by teacher Yanyan Jiang from Nanjing University on the operating system course.

- Model checker by Yanyan Jiang(Download at http://jyywiki.cn/pages/OS/2022/demos/model-checker.py and http://jyywiki.cn/pages/OS/2022/demos/visualize.py), slightly modified by Guangwei Zhang (added halting indication)
- Example programs http://jyywiki.cn/pages/OS/2022/demos/mutex-bad.py
- Use command `./model-checker.py | ./visualize.py > output.html` to visualize.

Adopted version is at `prog-visualize` folder.