Concurrency & Parallelism
Test 2 - 2015/16

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1 Question 1

Competition Accessing a critical section, threads have to compete to get time over the critical section.

Cooperation A barrier is useful to make processes wait on each other, e.g. we have function $f(x, y)$ and both x and y are results from other functions running concurrently, to run f we need to wait on both.

2 Question 2

2.1 a)

Smallest	11
Largest	11

2.2 b)

Smallest	11	11	11
Largest	11	11	11

2.3 c)

Smallest	3	4	5
Largest	9	10	11

3 Question 3

x	$2, 4, 5, 6$
y	$1, 3, 4$
(x, y)	$(2, 1), (4, 3), (4, 4), (5, 3), (5, 4), (6, 4)$

4 Question 4

5 Question 5

- F
- T
- F
- F
- F
- F
- T
- F
- T
- F
- F
- T
- T

6 Question 6

- Deadlock - Progress
- Livelock - Progress
- Starvation - Progress
- Busy-Waiting - Progress
- All threads simultaneously execute a `lock(X)` over the same lock variable X - Progress
- All threads simultaneously execute a `compareAndSwap(X,v)` over the same variable X - No Progress

7 Question 7

7.1 a)

See Figure 1

7.2 b)

7.2.1 i)

$\Sigma_{00}, \Sigma_{10}, \Sigma_{20}, \Sigma_{30}, \Sigma_{31}, \Sigma_{32}, \Sigma_{33}, \Sigma_{34}, \Sigma_{44}, \Sigma_{54}, \Sigma_{55}, \Sigma_{56}$

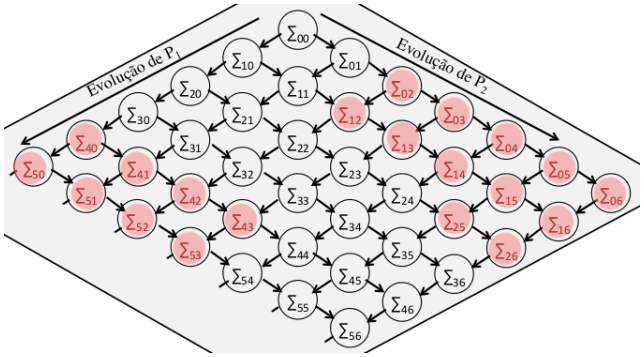

Figure 1:

7.2.2 ii)

$\Sigma_{00}, \Sigma_{01}, \Sigma_{02}, \Sigma_{03}, \Sigma_{31}, \Sigma_{32}, \Sigma_{33}, \Sigma_{34}, \Sigma_{44}, \Sigma_{54}, \Sigma_{55}, \Sigma_{56}$

7.2.3 iii)

7.2.4 iv)

7.2.5 v)

8 Question 8

```
Node oldTop = top.get();
node.next = oldTop;
return = top.compareAndSet(oldTop, node);
```

9 Question 9