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INF 4140: Models of Concurrency

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Series 1

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Topic: Warm-up: thinking concurrently and basic synchronization

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```
For the exercises: do exercises 2.1, 2.2, 2.10, 2.12, 2.13, 2.14,
and 2.15  from the textbook
```

Exercise 1 (Synchronization) Do the exercise 2.1 from the book.

Exercise 2 Consider the code of the simple producer-consumer problem. Change it so that the variables p and q are process-local, not global.

Listing 1: Producer/consumer, global p and q

```

              int buf, p := 0; c := 0;

process Producer {                process Consumer {
  int a[N];...                    int b[N];...
  while (p < N) {                 while (c < N) {
    < await (p = c) ; >            < await (p > c) ; >
    buf := a[p];                    b[c] := buf;
      p := p+1;                        c := c+1;
 }                                  }
}                                 }
```

Exercise 3 (Histories and atomicity) Do 2.10 from the book. Consider the shown code. How many histories are there? What are they possible final values.

```
   int x = 0, y = 0;
co
   x := x + 1; # S1
   x := x + 2; # S2
||
   x := x + 2; # P1
   y := y - x; # P2
oc
```

Exercise 4 (Interleaving, non-determinism, and atomicity) Do exercise 2.12 from the book. Consider

```
     int x = 2, y = 3;

co
   <x := x + y;> #S1
||
   <y := x * y;>   #S2
oc
```

1. does the prog. satisfies the AMO property?
2. what's the result(s)?

Exercise 5 Do exercise 2.13 from the book.

```
S1 =  x := x+2              S2 =  y := x-y                 S3 =  x := x-y


a) S1; S2; S3

b) co
         <S1;>
      ||
         <S2;>
      || <S3;>
   oc

c) co <await x > y S1;S2> || S3 oc
```

Exercise 6 (At most once) Do exercise 2.14 from the book. Consider the following code

```
  int x = 1, y = 1;
  co
     <x := x+y;>        #1
  ||
     y := 0;            #2
  ||
     x := x - y;        #3
  oc
```

Exercise 7 (AMO, termination) Do exercise 2.15 from the book.

```
    int x = 0, y = 10;

co
    while (x != y) x := x + 1;
||
    while (x != y) y := y - 1;
oc
```

1. AMO?

2. Termination?q

References

[1] G. R. Andrews. *Foundations of Multithreaded, Parallel, and Distributed Programming.* Addison-Wesley, 2000.