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Please hand in your solution until
26.7.2017, 2pm, via email to
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Tutorials for “Formal methods for Java”
Exercise sheet 12

Exercise 1: Predicate Abstraction

Consider the following Java method that efficiently computes the binomial coefficient $\binom{n}{k}$.

```
 1 int binom(int n, int k) {
 2   int b = 1;
 3   int i = 0;
 4   while (i < k) {
 5     i++;
 6     assert i != 0;
 7     b = b * (n - k + i) / i;
 8   }
 9   return b;
10 }
```

Prove that line 7 will never perform a divison by 0 by showing that the given assert statement is never violated. (Assume that no integer overflows occur.) In order to do this take the following steps.

(a) Construct the program counter abstraction (as in the lecture) of the method `binom`. Highlight a spurious error trace in the program counter abstraction graph.

(b) Construct a fresh abstraction from the program counter abstraction by applying predicate abstraction using the predicates $i = 0$ and $i > 0$. You can omit unreachable and empty abstract states.