

SE 2A04 Fall 2002

Surprise Quiz 1 Version B Answer Key

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The Oberon-2 procedure Q given below implements a function

$$f : \text{INTEGER} \times \text{INTEGER} \rightarrow \text{INTEGER}.$$

```
PROCEDURE Q(x,y: INTEGER): INTEGER;
  VAR i,z: INTEGER;
BEGIN
  IF ((x <= 0) OR (y < 0)) THEN
    Out.String("Q: Bad input!");
    RETURN -1
  ELSE
    i := 0;
    z := 1;
    WHILE (i < y) DO
      i := i + 1;
      z := z * x
    END;
    RETURN z
  END
END Q;
```

- (1) [30 pts.] Does the loop in the body of Q always terminate? If so, what is the strictly decreasing natural number value for the loop?

Answer: Yes. $y - i$.

- (2) [40 pts.] What invariant for the loop best describes the behavior of the loop?

Answer: $0 \leq i \leq y \wedge z = x^i$

- (3) [30 pts.] Complete the following definitional specification of f :

$f = (\lambda x, y : \text{INTEGER} .$

Answer: $f = (\lambda x, y : \text{INTEGER} . \text{if}(x \leq 0 \vee y < 0, -1, x^y))$