Q0 [10]
Complete the following proof outline validly.

```

## ¬f ∨ x == Z

# Global inv: __________________________
co

## (await( f ) y := 2x ;)

## __________________________
//

## __________________________
(f, x := true, Z;)

## __________________________
oc

## y == 2Z
```

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Name:
Student #:
Q0 [10]

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Midterm
Engi 8893
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Total marks: 30
**Q1 [10] Barrier**

Exactly \( N \) threads need to do a barrier synchronization. Each thread \( i \) calls procedure

```
procedure barrier( int i )
```

with \( i \) as argument. Design a monitor that exports procedure `barrier`. Use either Andrew's design notation or Java with the `monitor` package. Document the invariant and any assertions associated with condition variables.
Q2 [10] Sum
We want to parallelize

\[
\text{for } [ i = 0 \text{ to } N - 1 ] \{ \ A[i] := \sum_{j \in \{0,...,i\}} B[j] \times C[N - 1 - j] ; \}
\]

Design an algorithm (in psuedocode) for a fast \(O(\log N)\) time with \(N\) processors) solution using shared memory and barrier synchronization. (Each process \(p\) calls \texttt{barrier}(\(p\)) to synchronize with the others.)