331 Let a and b be binary expressions with unprimed variables, and let A , B , C , P , Q , R , S , T , and U be implementable specifications such that the refinements

$A \Leftarrow$ **if** a **then** ok **else if** b **then** P. B **else** Q. C **fi fi**
$B \Leftarrow$ **if** a **then** ok **else if** b **then** R. C **else** S. A **fi fi**
$C \Leftarrow$ **if** a **then** ok **else if** b **then** T. A **else** U. B **fi fi**

are all theorems. Then A can be executed as follows (using ⸬ for labeling):

A⸬ **if** a **then go to** D **else if** b **then** P. **go to** B **else** Q. **go to** C **fi fi**.
B⸬ **if** a **then go to** D **else if** b **then** R. **go to** C **else** S. **go to** A **fi fi**.
C⸬ **if** a **then go to** D **else if** b **then** T. **go to** A **else** U. **go to** B **fi fi**.
D⸬ ok

We have replaced refinement and call with labeling and **go to**s.

(a) Show that it is not possible to replace refinement and call (in this example) with **while** loops without introducing any new variables.

(b) Show that it is possible to replace refinement and call (in this example) with **while** loops if you introduce new variables.

no solution given