Exercise on Relations in Event-B
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Assume the following 2 relations:

$$\begin{aligned} A &= \{\ a1 \mapsto b3,\ a2 \mapsto b1, a3 \mapsto b3, a2 \mapsto b6\ \} \\ B &= \{\ b3 \mapsto c1,\ b1 \mapsto c2, b5 \mapsto c1\ \} \end{aligned}$$

1. Compute $\{a1, a3, a4\} \lhd A$

2. Compute $B \rhd \{c1, c3\}$

3. Compute $A\ ; B$

4. A hotel reception system allocates guests to rooms. Each room is allocated to at most one guest. When a guest checks in, the system finds a free room and allocates that room to them. When they check-out, the room is de-allocated. Write a B specification of a system that manages the allocation of rooms. Include a check-in operation and a check-out operation.

5. Add an operation to the room allocation system to check which room(s) a guest is allocated to.

6. Extend your B model so that the hotel has a variable set of rooms that can be extended or reduced. Add operations to add and remove rooms. Extend the existing operations where necessary.