125 Here are four specifications in integer variables x and y.

(i) $x := 2.\ y := 3$

(ii) $x' = 2.\ y' = 3$

(iii) $(x := 2) \wedge (y := 3)$

(iv) $x' = 2 \wedge y' = 3$

(a) Which of them make the final value of x be 2 and the final value of y be 3?

(b) Which of them are implementable, and which are unimplementable?

(c) Which of them are deterministic, and which are nondeterministic?

(d) If the state variables are x, y, and z, which of them are deterministic, and which are nondeterministic?

After trying the question, scroll down to the solution.

§ Using the definitions of assignment and sequential composition, here are the four specifications as standard binary expressions, simplified.

(i) $x'=2 \wedge y'=3$
(ii) $y'=3$
(iii) $x'=x=2 \wedge y'=y=3$
(iv) $x'=2 \wedge y'=3$

Here is (ii) in detail:

$x'=2.\ y'=3$
$=$ $\exists x'', y'' \cdot\ x''=2 \wedge y'=3$ one-point for x'', and y'' doesn't appear
$=$ $y'=3$

(a) Which of them make the final value of x be 2 and the final value of y be 3 ?
§ (i) and (iv). (ii) leaves x' unspecified. (iii) is unimplementable.

(b) Which of them are implementable, and which are unimplementable?
§ (i), (ii), and (iv) are implementable. (iii) is unimplementable.

(c) Which of them are deterministic, and which are nondeterministic?
§ (i), (iii), and (iv) are deterministic because they specify a single value for both x' and y'. (ii) is nondeterministic because x' could be anything..

(d) If the state variables are x, y, and z, which of them are deterministic, and which are nondeterministic?
§ The four specifications are now

(i) $x'=2 \wedge y'=3 \wedge z'=z$
(ii) $y'=3$
(iii) $x'=x=2 \wedge y'=y=3 \wedge z'=z$
(iv) $x'=2 \wedge y'=3$

(i) and (iii) are deterministic. (ii) and (iv) are nondeterministic.