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:

$x'=2.\ y'=3$

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

$=\quad y'=3$

(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 the final value of 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 x' . (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.