

1.

a. $\text{fun3}(10, 4)$
 $x=10, y=4$
 $x > y$
 $\Rightarrow \text{return } -1 \#$

b. $\text{fun3}(4, 3)$
 $x=4, y=3$
 $x > y$
 $\Rightarrow \text{return } -1 \#$

c. $\text{fun3}(4, 7)$
 $x=4, y=7$
 $x < y$
 $\Rightarrow \text{return } (4 * \text{fun3}(5, 7))$
 $\text{fun3}(5, 7)$
 $x=5, y=7$
 $x < y$
 $\Rightarrow \text{return } (5 * \text{fun3}(6, 7))$
 $\text{fun3}(6, 7)$
 $x=6, y=7$
 $x < y$
 $\Rightarrow \text{return } (6 * \text{fun3}(7, 7))$
 $\text{fun3}(7, 7)$
 $x=7, y=7$
 $x = y$
 $\Rightarrow \text{return } 1$
 $\Rightarrow \text{return } 6 * 1$
 $\Rightarrow \text{return } 5 * 6 * 1$
 $\Rightarrow \text{return } 4 * 5 * 6 * 1 = 120 \#$

d. $\text{fun3}(0, 0)$
 $x=0, y=0$
 $x = y$
 $\Rightarrow \text{return } 1 \#$

2.

Algorithm Ackerman(m, n)

if (m = 0)

 return (n+1)

else if (n = 0 and m > 0)

 return Ackerman(m-1, 1)

else

 return Ackerman(m-1, Ackerman(m, n-1))

end if

end Ackerman

①

$$A(2,3) = A(1, A(2,2))$$

$$A(1, A(2,1))$$

$$A(1, A(2,0))$$

$$A(1,1)$$

$$A(0, A(1,0)) = 3$$

$$A(0,1) = 2$$

$$A(1,3)$$

$$A(0, A(1,2)) = 5$$

$$A(0, A(1,1)) = 4$$

$$A(0, A(1,0)) = 3$$

$$A(0,1) = 2$$

$$A(1,5)$$

$$A(0, A(1,4)) = 7$$

$$A(0, A(1,3)) = 6$$

$$A(0, A(1,2)) = 5$$

$$A(0, A(1,1)) = 4$$

$$A(0, A(1,0)) = 3$$

$$A(0,1) = 2$$

$$A(1,7)$$

$$A(0, A(1,6)) = 9 \#$$

$$A(0, A(1,5)) = 8$$

$$A(0, A(1,4)) = 7$$

$$A(0, A(1,3)) = 6$$

$$A(0, A(1,2)) = 5$$

$$A(0, A(1,1)) = 4$$

$$A(0, A(1,0)) = 3$$

$$A(0,1) = 2$$

$$\Rightarrow A(2,3) = 9 \#$$

②

$$A(2,5) = A(1, A(2,4))$$

$$A(1, A(2,3))$$

9 (by ①)

$$A(1,9)$$

$$A(0, A(1,8)) = 11$$

$$A(0, A(1,7)) = 10$$

⋮

$$A(0, A(1,0)) = 3$$

$$A(0,1) = 2$$

$$A(1,11)$$

$$A(0, A(1,10)) = 13 \#$$

$$A(0, A(1,9)) = 12$$

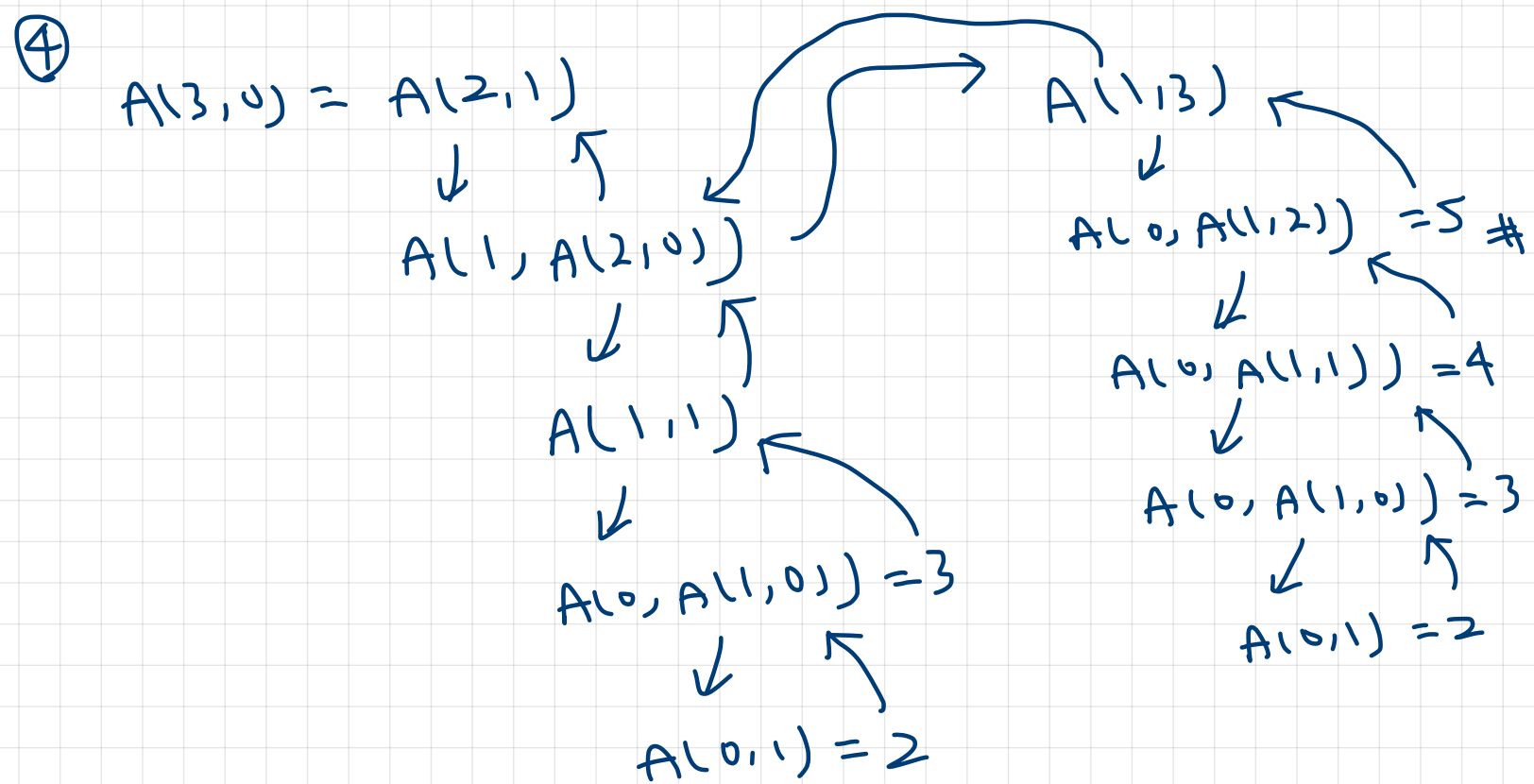
⋮

$$A(0, A(1,0)) = 3$$

$$A(0,1) = 2$$

$$\Rightarrow A(2,5) = 13 \#$$

③ $A(0,3) = 4 \#$



$\Rightarrow A(3,0) = 5 \#$