

*S × S* (*a, b*) *∈ R aRb S*1*, S*2*, . . . , Sn  Si aRb*

*•*

*•* (*p−q*)

*•*

*•*

*• •*

(*i, j*) *∈ R*



*O*(*N*)

*x ∈ S*

*{*0*}, {*1*}, . . . , {N −*1*} a, b, . . . , z*

*O*(1) *O*(*N*) *O*(*N*2) log *N* log *N O*(*N* log *N*) *O*(*M* + *N* log *N*)

*A*+ = *A* + *A*2 + *A*3 + *· · · An*



*O*(*M* + *N*)

*•* = *•*

*O*(*N*)

*{*1*,* 2*}, {*3*,* 4*,* 5*}, {*6*,* 7*}, {*8*,* 9*}, {*10*}*

**1 3**

**6**

**9**

**10**

**2**

**4 5 8 7**

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |



**1 2**

**3**

**4 5**

**9 10**

**6 8**

**7**

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |

**10**

**1**

**3**

**4 5**

**9**

**2**

**6 8 7**

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |



**3**

**1 4 5**

**2**

**10**

**6 7 9 8**

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |





*A*(0*, n*) = *n* + 1

*A*(*m* + 1*,* 0) = *A*(*m,* 1)

*A*(*m* + 1*, n* + 1) = *A*(*m, A*(*m* + 1*, n*))

*A*0(*n*) = *n* + 1

*Am*+1(0) = *Am*(1)

*Am*+1(*n* + 1) = *Am*(*Am*+1(*n*))

*A*0  *A*0(*n*) = *n*+ 1 *A*1(*n*) *m* = 0

*A*1(0) = *A*0(1) = 1 + 1 = 2

*A*1(*n*) = *A*0(*A*1(*n −* 1))

= *A*1(*n −* 1) + 1

= *A*1(*n −* 2) + 1 + 1

= *A*1(*n −* 3) + 1 + 1 + 1

= *A*1(0) + *n*

= *n* + 2



*A*2(*n*) *A*1(*n*) *n* + 2 *A*2(0) = *A*1(1) = 1 + 2 = 3

*A*2(*n*) = *A*1(*A*2(*n −* 1))

= *A*2(*n −* 1) + 2

= *A*2(*n −* 2) + 4

= *A*2(*n −* 3) + 6

= *A*2(0) + 2*n*

= 2*n* + 3

*m* = 4 *m n*

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |
|  |  |  | 265536 *−* 3 | 2265536 *−* 3 | 2265536 *−* 3 |  |
|  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |

*A*4(*n*) *n ≥* 2 *m >* 4 *Am  A*(*m, m*) *A ∗* (*k*) = *A*(*k, k*) *α*(*n*) *A ∗* (*k*) *α*(*n*) *k*

*A ∗* (*k*) *< n ≤ A ∗* (*k* + 1)

*α*(2) = 0 *A*(0*,* 0) = 1 *A*(1*,* 1) = 3 *α*(62) = 3 *A*(3*,* 3) = 61 *A*(4*,* 4) = *A*(3*,* 2265536 *−* 3) *n A*(3*,* 2265536 *−* 3) *α*(*n*) = 3 *α*(*n*)

*O*(*Mα*(*N*)) *α*(*n*)

*α*(*n*) *O*(*M*)



*c d*