# DESIGN AND ANALYSIS OF ALGORITHMS

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# HOMEWORK 2

## Question 1

**Thread**: Compute the following sums:

**Answer:**

1. = +
2. (B)

* Solve (A):

= 1.2 + 2.3 + … + 2n(2n+1)

= (1 + 2 + 3 + … + 2n) + (12 + 22 + … + (2n)2)

= n(2n + 1) + [12 + 22 + … + (2n)2] (3)

* + Solve: 12 + 22 + … + (2n)2

= [(12 + 32 + … + (2n - 1)2] + [(22 + 42 + … + (2n)2]

=+

= (4)

Put (4) into (3), we have

1. = (5)

* Solve (2):

= (2n + 1)(2n + 2) + (2n + 2)(2n + 3) + (2n + 3)(2n + 4)

= [(2n + 1) + (2n + 2) + (2n + 3)] + [(2n + 1)2 + (2n + 2)2 + (2n + 3)2]

= 6(n + 1) + [(2n + 1)2 + (2n + 2)2 + (2n + 3)2] (6)

* + Solve: [(2n + 1)2 + (2n + 2)2 + (2n + 3)2]

= 12n2 + 24n + 14 (7)

Put (7) into (6), we have (8)

1. = 6(n + 1) + 12n2 + 24n + 14

* From (5) and (8) , we have

= + 6(n + 1) + 12n2 + 24n + 14

= + 12n2 + 30n + 20

1. =

=

1. = 1 + 2(1 + 2) + 3(1 + 2 + 3) + … + n(1 + 2 + 3 + … + n)

= 1 + + + … +

= 1 + [22 + 32 + … + n2] + [23 + 33 + … + n3]

= 1 + +

= + +

= .

1. = 2

= 2

= 2.

= 1 +

## Question 2

**Thread**: Consider the following algorithm.

ALGORITHM

**function** Enigma(A[0…n - 1; 0…n - 1])

* + Input: A matrix A[0…n - 1; 0…n - 1] of real numbers

**for** i = 0 to n - 2 do

**for** j = i + 1 to n - 1 **do**

**if** A[i; j] = A[j; i] **then** **return** false

**return** true

(a) What does this algorithm do?

(b) What is its basic operation?

(c) How many times is the basic operation executed in the best and worst cases?

(d) What is the efficiency class of this algorithm?

(e) Suggest an improvement, or a better algorithm altogether, and indicate its effi-

ciency class. If you cannot find an improvement, try to prove that the problem

can't be solved by an algorithm in a better efficiency class.

**Answer:**

1. This algorithm is performed to check whether this matrix is a adjacency matrix or not.
2. The algorithm’s basic operation is equal ( = ).
3. The basic operation executed in the best and worst cases are 1 and n2 times respectively.
4. The efficiency class of this algorithm is n2.