

## problem 1A

```
[yg336@wind ~/inf503/homework2]$ jobstats -r
JobID      JobName      ReqMem      MaxRSS      ReqCPUS      UserCPU      Timelimit    Elapsed      State      JobEff
=====
37473526    problem1A    19.5G       3.24G       1            00:25.001    00:10:00     00:01:45    COMPLETED 17.04
=====
```

Fig.1

```
yg336@wind:~/inf503/homework2
The number of arguments passed: 4
The first argument is: main
The second argument is: problem1A
The third argument is: /common/contrib/classroom/inf503/hw_dataset.fa
The fourth argument is: /common/contrib/classroom/inf503/test_genome.fasta
time used for reading all the reads is: 9 s
memory released!
```

Fig.2

## problem 1B

```
FASTAreadset_LL::~FASTAreadset_LL()
{
    Node *temp1, *temp2;
    temp1 = head;
    temp2 = head;
    while(temp1 != NULL)
    {
        delete[] temp1->sequence;
        temp1 = temp1->next;
        delete[] temp2;
        temp2 = temp1;
    }
    cout << "memory released!" << endl;
}
```

From problem 1A we can see that the memories can be released by this destructor.

$O(n)$ . When releasing the memories, the program just deallocate the memories one by one.

## problem 1C

```
FASTAreadset_LL::FASTAreadset_LL(const FASTAreadset_LL &obj)
{
    this->init();
    Node *temp1, *temp2;
    temp1 = obj.head;
    if(temp1 == NULL)
```

```

    {
        return;
    }

    this->head = new Node;
    temp2 = this->head;
    temp2->sequence = new char[51];
    strcpy(temp2->sequence, temp1->sequence);

    temp1 = temp1->next;

    while(temp1 != NULL)
    {
        temp2->next = new Node;
        temp2 = temp2->next;
        temp2->sequence = new char[51];
        strcpy(temp2->sequence, temp1->sequence);
        temp1 = temp1->next;
    }
}

```

```

The number of arguments passed: 4
The first argument is: ./main
The second argument is: problemlC
The third argument is: /common/contrib/classroom/inf503/hw_dataset.fa
The fourth argument is: /common/contrib/classroom/inf503/test_genome.fasta

first 10 segments from the file:
GTAAGTGAAGTGTGTTGGTCAGCTCAGCGACTACAGACGACTTGTAGTAAT
AGGGGCGAGGCGTACGGCCTTTTCTTCGCGCTCGTCGCGAACGACCGCGCG
AATGGCTTTTTTTTCCAAAGATAAAACCGAATTTTTTAATATATTTACTGAC
GTGACCCAGAAACCCAAACCGATCATGATGCGTCTGCAATCGGATCTGGTT
TTCCGAAAGCTGTACTAAGCCTTTTCAGCAGTTGCTTTTGCTTGAGTGGGT
ACGAGAACTGATAGCCGGCCGTCACCGCGACGCGCTGCTCCGCCTGCGCG
TGTCGAAGGATGTCGGTAAATCGATATTCTGTGTCGAAACGTCGATATAA
AAACATGTTGATACAACTGAGTACATTAAACTAGACTATAGCTATTTCATA
ACAAAGAAGGTTGGTTTTTCTGGTTTTTGGCCTTCCTGCCTGAATCCAAGT
ACCATTAATTGATTTTGTTCAGATGCACATCCATTTGTGGGAATGGAATT

first 10 segments from the copied object:
GTAAGTGAAGTGTGTTGGTCAGCTCAGCGACTACAGACGACTTGTAGTAAT
AGGGGCGAGGCGTACGGCCTTTTCTTCGCGCTCGTCGCGAACGACCGCGCG
AATGGCTTTTTTTTCCAAAGATAAAACCGAATTTTTTAATATATTTACTGAC
GTGACCCAGAAACCCAAACCGATCATGATGCGTCTGCAATCGGATCTGGTT
TTCCGAAAGCTGTACTAAGCCTTTTCAGCAGTTGCTTTTGCTTGAGTGGGT
ACGAGAACTGATAGCCGGCCGTCACCGCGACGCGCTGCTCCGCCTGCGCG
TGTCGAAGGATGTCGGTAAATCGATATTCTGTGTCGAAACGTCGATATAA
AAACATGTTGATACAACTGAGTACATTAAACTAGACTATAGCTATTTCATA
ACAAAGAAGGTTGGTTTTTCTGGTTTTTGGCCTTCCTGCCTGAATCCAAGT
ACCATTAATTGATTTTGTTCAGATGCACATCCATTTGTGGGAATGGAATT

memory released!
memory released!

```

Fig.3

$O(n)$ . When copying all the elements from an object to another, the program copy them one by one.

## problem 1D

```
yg336@wind:~/inf503/homework2
The number of arguments passed: 4
The first argument is: main
The second argument is: problem1D
The third argument is: /common/contrib/classroom/inf503/hw_dataset.fa
The fourth argument is: /common/contrib/classroom/inf503/test_genome.fasta
CTAGGTACATCCACACACAGCAGCGCATTATGTATTTATTGGATTTATTT found!
GCGCGATCAGCTTCGCGCGCACCGCGAGCGCCGATTGCACGAAATGGCGC found!
CGATGATCAGGGGCGTTGCGTAATAGAACTGCGAAGCCGCTCTATCGCC not found!
CGTTGGGAGTGCTTGTTTGTAGCGCAAATGAGTTTTCGAGGCTATCAAAAA found!
ACTGTAGAAGAAAAAGTGAGGCTGCTCTTTTACAAGAAAAAGTNNNNNN found!
memory released!
```

Fig.4

## problem 2A

The number of 50-character fragments is 5227244.

```
yg336@wind:~/inf503/homework2
The number of arguments passed: 4
The first argument is: main
The second argument is: problem2A
The third argument is: /common/contrib/classroom/inf503/hw_dataset.fa
The fourth argument is: /common/contrib/classroom/inf503/test_genome.fasta
The number of 50-character fragments is: 5227244
memory released!
```

Fig.5

## problem 2B

1000 searches

```
yg336@wind:~/inf503/homework2
The number of arguments passed: 4
The first argument is: main
The second argument is: problem2B
The third argument is: /common/contrib/classroom/inf503/hw_dataset.fa
The fourth argument is: /common/contrib/classroom/inf503/test_genome.fasta

Reads in the read set: 36220412
segments in the genome file: 5227244

Found 797 50-character fragments in readset!
Time cost is: 256 s
memory released!
memory released!
```

Fig.6

10000 searches

```
yg336@wind:~/inf503/homework2
The number of arguments passed: 4
The first argument is: main
The second argument is: problem2B
The third argument is: /common/contrib/classroom/inf503/hw_dataset.fa
The fourth argument is: /common/contrib/classroom/inf503/test_genome.fasta

Reads in the read set: 36220412
segments in the genome file: 5227244

Found 8372 50-character fragments in readset!
Time cost is: 2373 s
memory released!
memory released!
```

Fig.7

100000 searches

```
yg336@wind:~/inf503/homework2
The number of arguments passed: 4
The first argument is: main
The second argument is: problem2B
The third argument is: /common/contrib/classroom/inf503/hw_dataset.fa
The fourth argument is: /common/contrib/classroom/inf503/test_genome.fasta

Reads in the read set: 36220412
segments in the genome file: 5227244

Found 83188 50-character fragments in readset!
Time cost is: 21905 s
memory released!
memory released!
```

Fig.8

From the results of 1000, 10000 and 100000 searches we can estimate that the total time consumption for 5227244 segments is about:

$$(5227244/100000)*21905 = 1145027 \text{ (s)} = 401 \text{ (h)}$$