All assignments are emailed to cislabs05@gmail.com

Assignment/Lab 3 - OOP

Please note that lab requires completion of Lab 2 successfully.

Create a new project called lab3 and add the following classes from Lab 2 in lab3:

A. HumanGenome.java
B. NucleicAcid.java

In this lab we will apply Association and Containment.

Association is implemented when an object is passed by reference to a method of another class or an object is returned from a method.

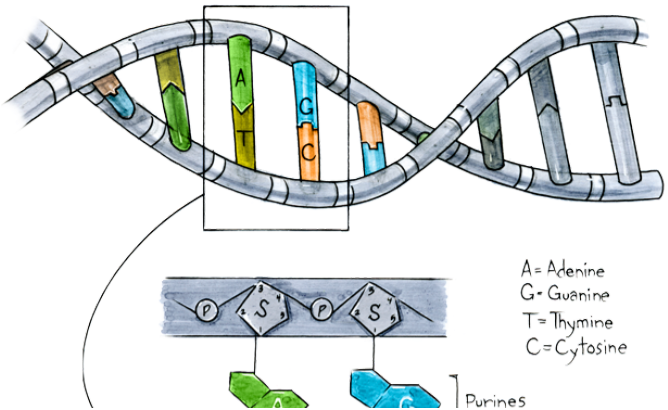
Containment refers to creating an object as an instance variable in another class.

Understanding DNA (Source - https://www.my46.org/intro/what-is-dna)

Deoxyribonucleic acid (DNA) is made of four molecules called bases, which are abbreviated as letters:

- A = Adenine
- T = Thymine
- C = Cytosine
- G = Guanine

Structure of DNA

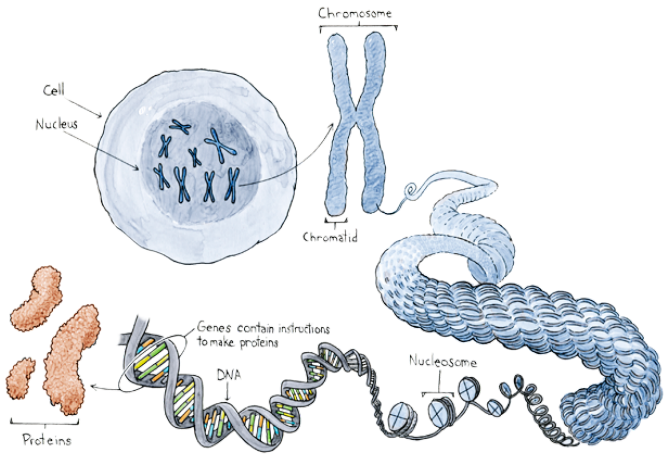


The letters or bases are linked together to make a strand of DNA. Two strands of DNA are paired together and form a structure called a double helix.

- Adenine, A, is always paired with thymine, T.
- Cytosine, C, is always paired with guanine, G.

The three-dimensional shape of a double helix looks like a twisted ladder. The paired bases (A-T and C-G) are like the rungs of the ladder.

The language of genetics has only four letters (A,T, C, and G). These four letters are combined into three-letter words (Codons). The words make up "genes," which are like sentences. Each sentence has an important meaning or story to tell. Genes provide the instructions to keep cells in your body doing their jobs.



Genes are packaged into chromosomes
DNA is organized into about 20,000 genes, and genes are packaged into chromosomes. You can think of your entire genetic code as a set of encyclopedias, and each chromosome as a separate volume. Normally, a person inherits half of their chromosomes from their mother and the other half from their father.

Most people have 23 pairs of chromosomes, for a total of 46 chromosomes.

Of these 46 chromosomes, two chromosomes determine if a baby is male or female. The sex chromosomes are called "X" and "Y." Most males have one X chromosome and one Y chromosome. Most females have two X chromosomes. In addition to the two sex chromosomes, the other chromosomes are called "autosomes" and are numbered 1-22.

Write a class called **DNA** to create two strands of DNA in the helix, implemented as an array of objects of type **NucleicAcid.** Each strand will have the same size.

DNA class should be created with following properties

1. LtoRHelix is an array of objects of type **NucleicAcid.**
2. RtoLHelx is an array of objects of type **NucleicAcid.**

DNA class should be created with following methods:

Default Constructor to initialize the properties to null.

public DNA ()

Overloaded constructor

public DNA (String strand)

that receives a String containing a sequence of Nucleic Acids represented with letters 'A', 'G', 'T' and 'C' (For e.g. "ATGCCTAGGATCAG") and

1. Populates LtoRHelix with corresponding objects using array of NucleicAcids.
2. Populates RtoLHelix with complementary NucleicAcid objects with following criteria:
   a. Adenine, A, is always paired with thymine, T.
   b. Cytosine, C, is always paired with guanine, G.

   For e.g.

   - if index value 0 in LtoRHelix contains A then populate RtoHHelix index value 0 should contain T
   - if index value 1 in LtoRHelix contains C then populate RtoHHelix index value 1 should contain G

public void LtoRHelixpopulate(String strand)

For input string ATGCCTAGGATCAG, parse it and for each nucleic acid (like A, T, G or C) create an object of type NucleicAcid in an array of Objects LtoRHelix. This method can be called in the overloaded constructor **public DNA (String strand) - String charAT() to parse the characters in the String name strand.**

public void print()

In this method, iterate through each index value and print the properties of each nucleic acid in the following array of objects:

- **LtoRHelix and**
- **RtoLHelix**

https://www.news-medical.net/life-sciences/START-and-STOP-Codons.aspx

public void highestMolarMass()

In this method print the index values and highest MolarMass of Nucleic Acid after traversing the following array of Objects:

- **LtoRHelix and**
- **RtoLHelix**

public void totalDensity()

In this method print the total Density of all Nucleic Acid within the following array of Objects:

- **LtoRHelix and**
- **RtoLHelix**

Write a driver class called DNADriver and test all the methods with following Strings

1. AGCCTAGGATCAG
2. AGCCTAGGATCTAGGATCAG

3. AGCCTATAGGATCAG
4. AAAGCCTAGGATAGGATCAG
5. AAAGCCTCTGAGGATAGGATCAG