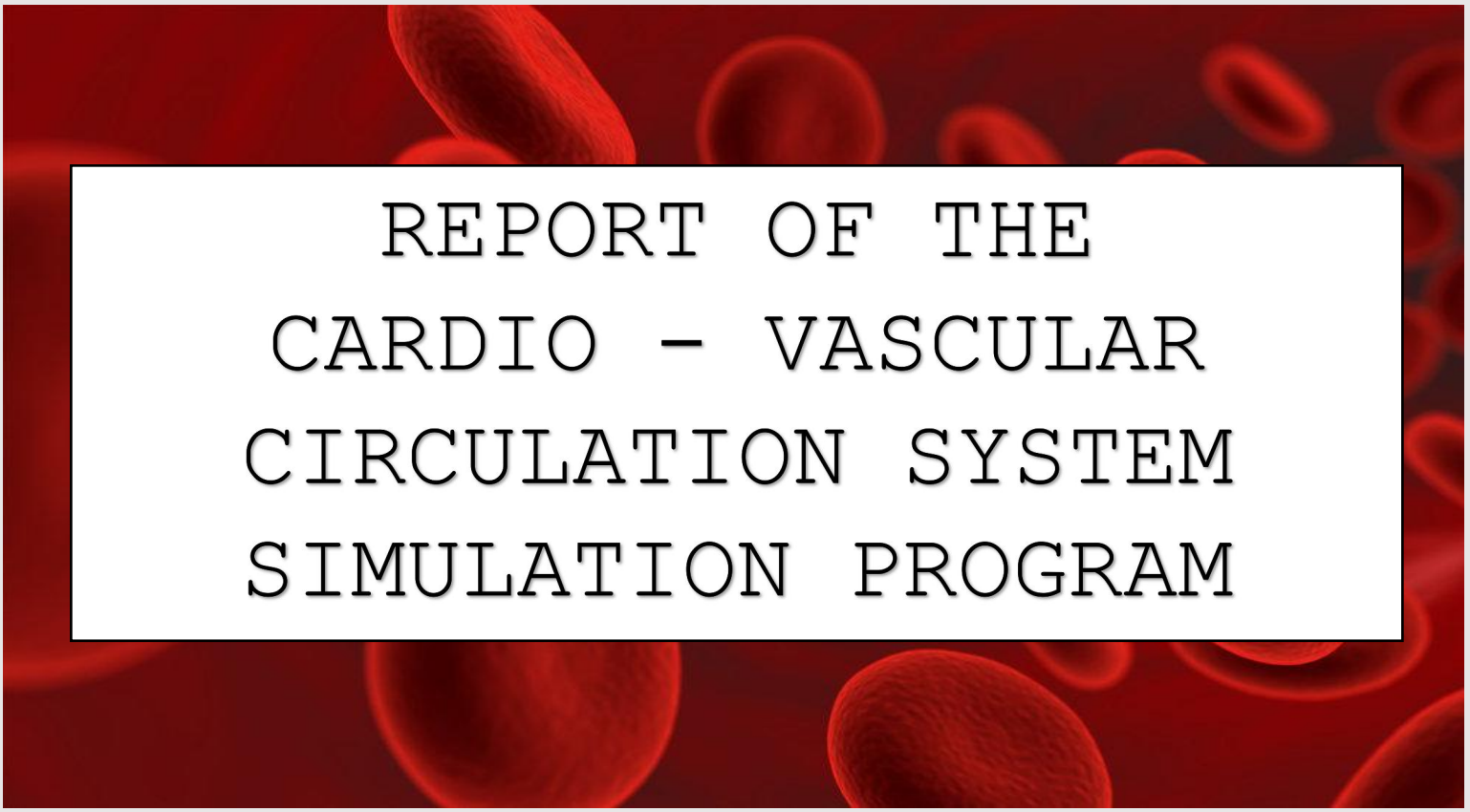


REPORT OF THE CARDIO – VASCULAR CIRCULATION SYSTEM SIMULATION PROGRAM

TABLE OF CONTENT

Assignment A

Index No : 18000401
Reg No : 2018 cs 040

INTRODUCTION

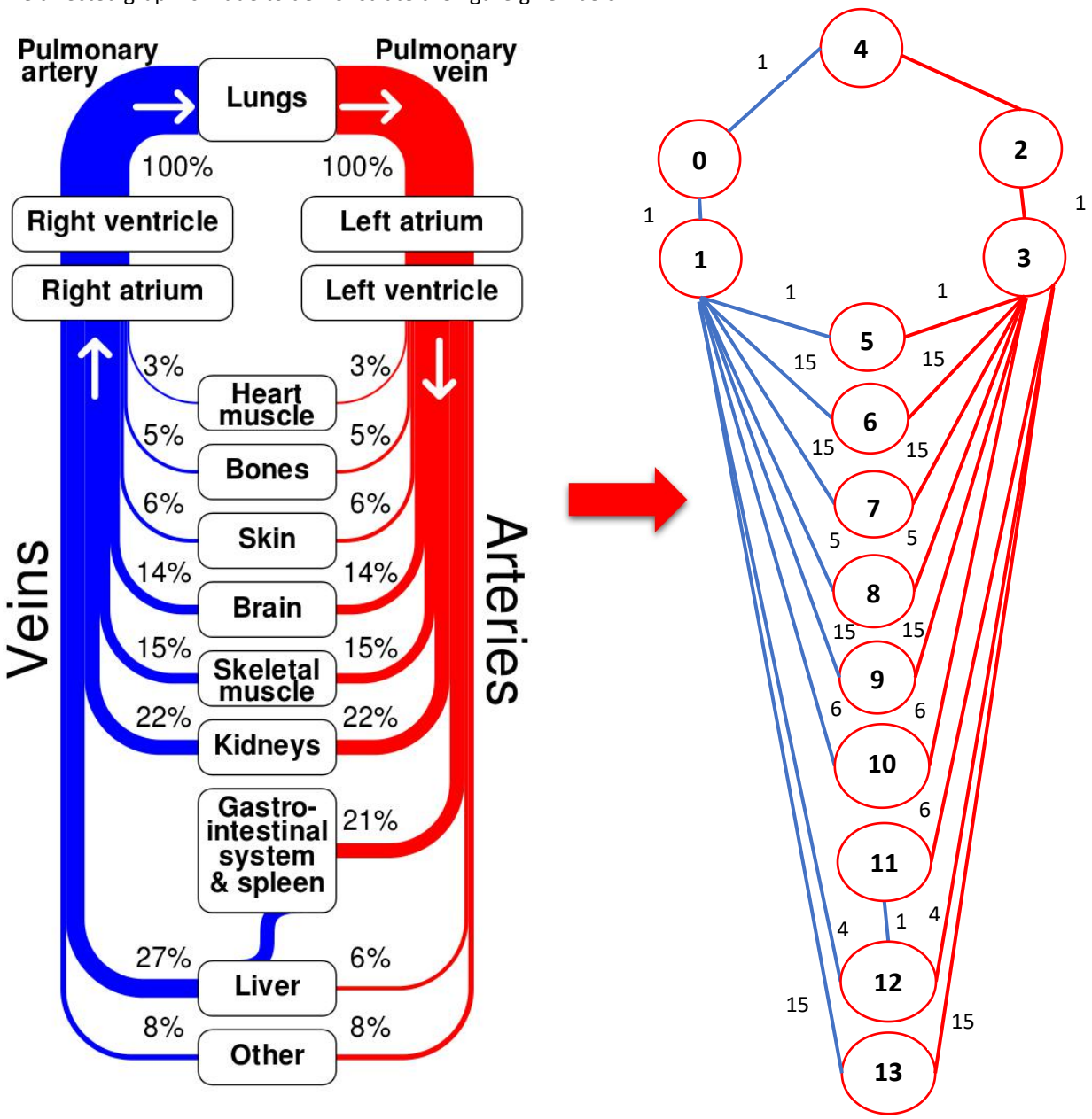
- The Cardio - Vascular system is modeled using the programming language C++
- Functionality - This program is tailored to do the following :

1. Creates a graph to depict the organs and connections of the human body.
2. Calculates the Total Blood Volume of an individual.
3. Demonstrates how the Total Blood Volume gets distributed among the modeled organs as oxygenated or de-oxygenated blood.
4. Calculates a rough number of Red Blood Cells, White Blood Cells & platelets to be modeled and creates that amount of cells.
5. Demonstrates how the created cells traverse through the human body.
6. Displays profiling information about Red Blood Cells, White Blood Cells & Platelets.

DESIGN & IMPLEMENTATION

-> *ORGAN GRAPH*

- The directed graph is made to demonstrate the figure given below :



- The Distances between the organs are estimated as follows :

1. Since the Left Atrium , Right Atrium , Left Ventricle , Left Atrium are situated in the heart, the distance between the four chambers is taken as 1 unit.
2. The lungs are located either side of the heart, therefore the distance between lungs and Left ventricle & right Atrium is also taken as 1 unit.
3. Since the heart muscle is located inside the heart, the distance between the heart muscle and Right Atrium & Left Ventricle is also taken as 1 unit.
4. Since bones and skin are spread throughout the body, this graph represents the bones & skin particles that are further away from the heart with the distance of 15 units.
5. Other represents other body parts such as legs and other body parts.This cannot be taken as an exact distance.Therefore in this graph that distance is roughly represented as 15 units.
6. Distances between the kidneys, Gastro - intestinal system & spleen, Liver connected to the Right Atrium & Left Ventricle are taken accordingly.

- The edges of this graph consists of the distance and the type of blood that is carried by the modeled blood vessel as follows :

{ 0, 4, 1, 'D'}	-	Right Ventricle to Lungs	-	Distance = 1	-	Type = De - Oxygenated Blood
{ 1, 0, 1, 'D' }	-	Right Atrium to Right Ventricle	-	Distance = 1	-	Type = De - Oxygenated Blood
{ 2, 3, 1, 'O' }	-	Left Atrium to Left Ventricle	-	Distance = 1	-	Type = Oxygenated Blood
{ 3, 13, 15, 'O' }	-	Left Ventricle to Other	-	Distance = 1	-	Type = Oxygenated Blood
{ 3, 12, 3, 'O' }	-	Left Ventricle to Liver	-	Distance = 3	-	Type = Oxygenated Blood
{ 3, 11, 6, 'O' }	-	Left Ventricle to Gastro-Intestinal System and Spleen	-	Distance = 6	-	Type = Oxygenated Blood
{ 3, 10, 6, 'O' }	-	Left Ventricle to Kidneys	-	Distance = 6	-	Type = Oxygenated Blood
{ 3, 9, 15, 'O' }	-	Left Ventricle to Skeletal Muscle	-	Distance = 15	-	Type = Oxygenated Blood
{ 3, 8, 5, 'O'}	-	Left Ventricle to Brain	-	Distance = 5	-	Type = Oxygenated Blood
{ 3, 7, 15, 'O' }	-	Left Ventricle to Skin	-	Distance = 15	-	Type = Oxygenated Blood
{ 3, 6, 15, 'O'}	-	Left Ventricle to Bones	-	Distance = 15	-	Type = Oxygenated Blood
{ 3, 5, 1, 'O' }	-	Left Ventricle to Heart Muscle	-	Distance = 1	-	Type = Oxygenated Blood
{ 4, 2, 1, 'O' }	-	Lungs to Left Atrium	-	Distance = 1	-	Type = Oxygenated Blood
{ 5, 1, 1, 'D' }	-	Heart Muscle to Right Atrium	-	Distance = 1	-	Type = De - Oxygenated Blood
{ 6, 1, 15, 'D'}	-	Bones to Right Atrium	-	Distance = 15	-	Type = De - Oxygenated Blood
{ 7, 1, 15, 'D' }	-	Skin to Right Atrium	-	Distance = 15	-	Type = De - Oxygenated Blood
{ 8, 1, 5, 'D' }	-	Brain to Right Atrium	-	Distance = 5	-	Type = De - Oxygenated Blood
{ 9, 1, 15, 'D' }	-	Skeletal Muscle to Right Atrium	-	Distance = 15	-	Type = De - Oxygenated Blood
{ 10, 1, 6, 'D' }	-	Kidneys to Right Atrium	-	Distance = 6	-	Type = De - Oxygenated Blood
{ 11, 12, 1, 'D' }	-	Gastro - Intestinal system & spleen to Liver	-	Distance = 1	-	Type = De - Oxygenated Blood
{ 12, 1, 4, 'D' }	-	Liver to Right Atrium	-	Distance = 4	-	Type = De - Oxygenated Blood
{ 13, 1, 15, 'D' }	-	Other organs to Right Atrium	-	Distance = 5	-	Type = De - Oxygenated Blood

- These edges are represented by using an **adjacency list** because this graph is a sparse graph :

	0	1	2	3	4	5	6	7	8	9	10	11	12	13
0		1			1									
1						1	1	1	1	1	1		1	1
2					1									
3			1											
4														
5				1										
6				1										
7				1										
8				1										
9				1										
10				1										
11				1										
12				1								1		
13				1										

As shown above the graph is sparse therefore for memory optimization the adjacency list method is used.

-> CALCULATING THE TOTAL BLOOD VOLUME OF AN INDIVIDUAL

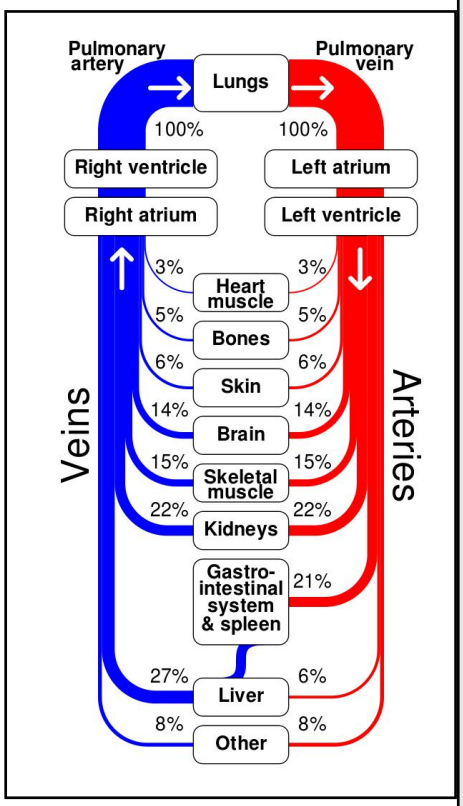
- According to the Nadler's Formula:

For Males = 0.3669 * HEIGHT in M3 + 0.03219 * WEIGHT in kgs + 0.6041
For Females = 0.3561 * HEIGHT in M3 + 0.03308 * WEIGHT in kgs + 0.1833

-This calculation is done to determine the total blood volume of an individual in Litres.
Note: Ht in M = Height in Meters, which is then cubed |Wt in kgs = Body weight in kilograms

-> DEMONSTRATING HOW THE TOTAL BLOOD VOLUME IS DISTRIBUTED IN THE HUMAN BODY

- An organ class is created in order to store the information such as :
  - Respective organ name for the respective organ ID
  - Flow rates of the connected artery & vein



- As shown in the diagram to the right, the above calculated total volume gets distributed according to their respective separation percentages.

- To show how the blood travels this program uses the Breadth First Traversal Method:

4	2	3	5	6	7	8	9	10	11	12	13	1	0

- The above is the queue after giving the starting vertex as four (lungs) for the BFS traversal

- This accurately represents the flow of blood from the Lungs to the rest of the body.

- This program shows how much of oxygenated blood flows from the lungs to the other organs as well as how those amounts flow back to the heart.

-> MODELNG THE THREE BLOOD CELL TYPES

- Three separate classes are coded to represent the three blood cell types : Red Blood Cells , White Blood Cells , Platelets

- According to the total blood volume calculated above, this program predicts roughly how many RBC, WBC & Platelet cells are in this particular individual according to the ratio between them.

RATIO -> RBC : WBC : Platelet
600 : 1 : 40

- According to research 1 ml of blood contains 5000 million cells
Therefore :

*Total Number of RBC cells = Total Blood Volume (in litres) * 1000 * 600 / 641 Million cells*
*Total Number of WBC cells = Total Blood Volume (in litres) * 1000 * 1 / 641 Million cells*
*Total Number of Platelet cells = Total Blood Volume (in litres) * 1000 * 40 / 641 Million cells*

- As shown above millions of cells are impossible to be modeled, therefore the following steps were taken to determine how many cells get modeled in the system.

- When modeling these cells, we should take in to consideration that a certain amount of cells gets produced & destroyed every second.
- According to research roughly 2 million cells per second gets produced by the bone marrow where as 2 million Cells gets destroyed at the liver / spleen to maintain the balance.
- In order to demonstrate this phenomenon as well the following calculation was done :

*Total Number of Cells that will be modeled = Total Number of cells / (2 * 60 * 24 * Life span)*

- Since we could take any amount of days to model, this program makes the calculation using the life span of the particular cell type
- However, in the case of White Blood cells an average life span has been given as a few hours to 13 - 15 days In this particular case this program takes another variable : modeled life span as 1 day in order to determine the no of cells.

Therefore :

*Number of RBC cells modeled = Total number of RBC Cells / (2 * 60 * 24 * 120)*
*Number of WBC cells modeled = Total number of WBC Cells / (2 * 60 * 24 * 1)*
*Number of Platelet cells modeled = Total number of Platelet Cells / (2 * 60 * 24 * 10)*

- The number of cells modeled represents the total number of cells (I.e. 1 cell actually represents a chunk of the actual number of cells)

-> MODELNG THE THREE BLOOD CELL TYPES INTO DATA STRUCTURES

- The following were taken into consideration when modelling these cell types in to data structures : -
  - Storage will not be an issue as only a certain amount of cells gets modeled anyway.
  -Therefore only the functionality of the cells must be considered :

RBC Cells -> Contains hemoglobin, a substance responsible for bringing carbon dioxide and oxygen throughout your body.
WBC Cells -> Cells of the immune system that are involved in protecting the body against both infectious disease and foreign invaders.
Platelets -> Blood cells that help your body form clots to stop bleeding

THEREFORE;
RBC Cells-> Has to traverse through the body , no cells are destroyed before the cell reaches it's life span.
WBC Cells-> Any cell from any part of the body can be used up , therefore the data structure must be chosen to facilitate deleting cells from any part.
Platelets -> As WBC, any cell from any part of the body can be used up or else they can travel through organs until it reaches it's life span.
- Considering the above, the modeled data structures are given below ;

* RBC Cells - **Circular Queue** -

A queue is selected because of it's First In First Out property ensuring that the cell produced first gets removed first.

A circular queue is selected instead of a normal queue in order to maintain the exact amount of cells without memory wastage.

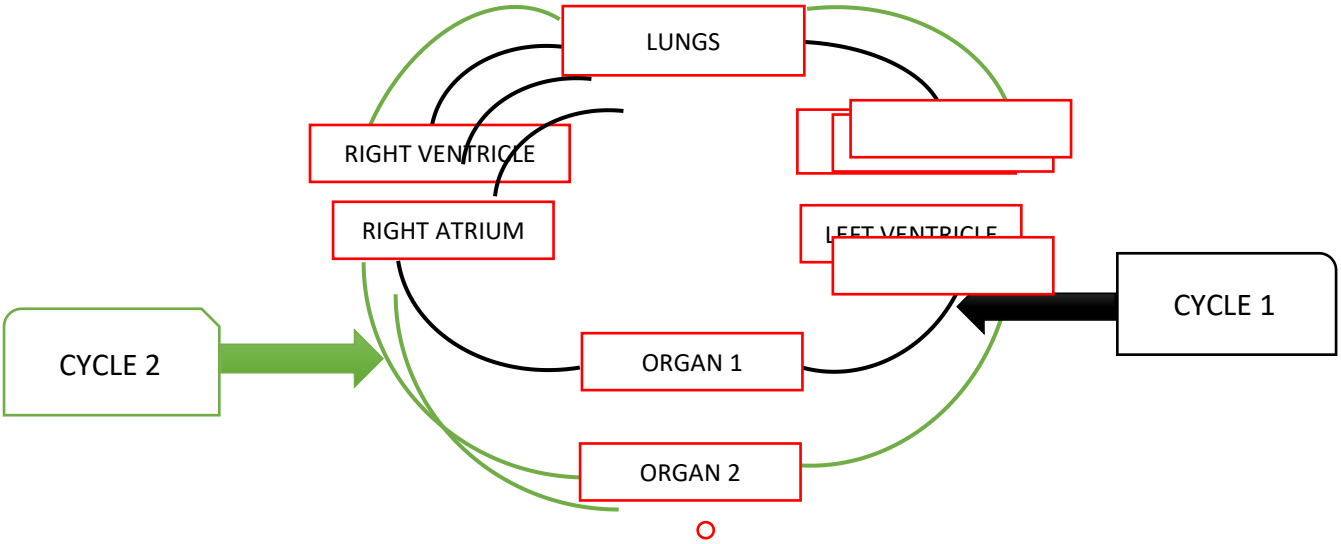
* WBC Cells & Platelets - **Linked List** -

Any cell can be deleted from anywhere & no memory wastage is incurred. Here the linked list is created from the cell objects it self.

-> TRAVERSING THE THREE BLOOD CELL TYPES IN THE HUMAN BODY

- The program allocates a cell Id for every RBC or WBC or Platelet cell created.
- This program then takes the first cell created and traverses that cell through all the organs.

-However, according to research, the path that a cell chooses in random and not every cell traverses the body in the same way.
Therefore, this program makes an assumption that each cell follows the path shown below :



- Here the cell traverses through each and every organ as shown above using the principles of Depth First Traversal.
- After one cell has traversed the body , the programs asks if you wish to see how the rest of the cells traverse. Here the remaining cells traverse the body as above.

-> WHEN THE THREE BLOOD CELL TYPES REACHES IT'S MODELED LIFE SPAN

- The programs asks the user if they wish to see what happens after the life span.

Here the first cell (element) in the respective data structure traverses the body and stops at the liver.

As blood cell gets destroyed at the liver, once the cell reaches the liver, that element is deleted from the data structure and a new element is added at the back of the data structure.
This depicts how a cell gets destroyed & a new cell is produced in the human body.

-> PROFILING INFORMATION

- As research shows the average cell take 60 seconds to complete one traversal using that information the following measurement was deducted ; Number of traversals per life span.

- The probabilities of a cell entering an organ is deducted as follows :

*= Blood Percentage passing through the organ * Cell Blood Volume * 1000 (ml) %*

- The Flow rate of each cell traversing through a particular organ is deducted as follow :

= Flow rate of the blood vessel * ratio

- Other related information such Life Span of a cell is given to the user as well.

INPUTS & OUTPUTS OF THE SYSTEM

Initial Interface

```
                                    CARDIO - VASCULAR CIRCULATION SYSTEM SIMULATION
*************************************************************************************************************************************


                                Please Enter the choice of your preference
-------------------------------------------------------------------------------------------------------------------------------------

        1.  How Blood travels through the heart and vital organs
        2.  How Platelet Cells travel through the human body
        3.  How White Blood Cells travel through the human body
        4.  How Red Blood cells through the human body
        5.  Display all profiling information about the blood cell types
        6.  EXIT
Enter choice :
```

Choice 1 : How Blood Travels through the Heart & Vital Organs

```
Enter choice :1


                CALCULATING BLOOD VOLUME
------------------------------------------------------------

Please Enter your gender :
Enter F for Female or M for Male : F
Enter your weight in kilograms (kg) : 40
Enter height in centimetres (cm) : 150

The blood volume of this individual is 2.70834 litres


Here's how the total Blood Volume travels through your body

2.70834 litres of Oxygenated Blood from Lungs travels to Left Atrium ->  Left Ventricle ->
-> 0.0812501 litres of blood travels through the Heart Muscle
-> 0.135417 litres of blood travels through the Bones
-> 0.1625 litres of blood travels through the Skin
-> 0.379167 litres of blood travels through the Brain
-> 0.406251 litres of blood travels through the Skeletal Muscle
-> 0.595834 litres of blood travels through the Kidneys
-> 0.568751 litres of blood travels through the Gastro-Intestinal System & Spleen
-> 0.1625 litres of blood travels through the Liver
-> 0.216667 litres of blood travels through the Other

De- oxygenated Blood from
- Heart Muscle
- Bones
- Skin
- Brain
- Skeletal Muscle
- Kidneys
- Gastro- Intestinal system & Spleen, Liver
 & Other organs
travels to Right Atrium-> Right Ventricle
```

After - CHOICE 1

```
                                 Please Enter the choice of your preference
---------------------------------------------------------------------------------

         1.  How Platelet Cells travel through the human body
         2.  How White Blood Cells travel through the human body
         3.  How Red Blood cells through the human body
         4.  Display all profiling information about the blood cell types
         5.  EXIT
Enter choice :
```

Choice 2 : How Platelet Cells Travels through the Human Body

```
The platelet Cell with cell ID 1 visited

 -> Right Ventricle

 -> Lungs

 -> Left Atrium

 -> Left Ventricle

 -> Heart Muscle

 -> Right Atrium
 -> Right Ventricle
 -> Lungs
 -> Left Atrium
 -> Left Ventricle

 -> Bones
 -> Right Atrium
 -> Right Ventricle
 -> Lungs
 -> Left Atrium
 -> Left Ventricle

 -> Skin
 -> Right Atrium
 -> Right Ventricle
 -> Lungs
 -> Left Atrium
 -> Left Ventricle

 -> Brain
 -> Right Atrium
 -> Right Ventricle
 -> Lungs
 -> Left Atrium
 -> Left Ventricle

 -> Skeletal Muscle
 -> Right Atrium
 -> Right Ventricle
 -> Lungs
 -> Left Atrium
 -> Left Ventricle
```

```
-> Kidneys
-> Right Atrium
-> Right Ventricle
-> Lungs
-> Left Atrium
-> Left Ventricle

-> Gastro-Intestinal System & Spleen

-> Liver
-> Right Atrium
-> Right Ventricle
-> Lungs
-> Left Atrium
-> Left Ventricle

-> Other
-> Right Atrium
-> Right Ventricle
-> Lungs
-> Left Atrium
-> Left Ventricle
```

```
Would you want to see the remaining 28 Platelet cells traverse through the body? YES - Y | NO - N : Y


The platelet Cell with cell ID 2 visited

 -> Right Ventricle

 -> Lungs

 -> Left Atrium

 -> Left Ventricle

 -> Heart Muscle

 -> Right Atrium
 -> Right Ventricle
 -> Lungs
 -> Left Atrium
 -> Left Ventricle

 -> Bones
 -> Right Atrium
 -> Right Ventricle
 -> Lungs
 -> Left Atrium
 -> Left Ventricle

 -> Skin
 -> Right Atrium
 -> Right Ventricle
 -> Lungs
 -> Left Atrium
 -> Left Ventricle

 -> Brain
 -> Right Atrium
 -> Right Ventricle
 -> Lungs
 -> Left Atrium
 -> Left Ventricle


Would you want to see the remaining 27 Platelet cells traverse through the body? YES - Y | NO - N : N
```

```
Would you like to see what happens after 10 day?   YES - Y | NO - N : Y


After 10 day the life of a platelet Cell ends.
Assuming that 10 day has passed :
The platelet Cell with cell ID 1 visites ->

 -> Lungs

 -> Left Atrium

 -> Left Ventricle

 -> Heart Muscle

 -> Right Atrium
 -> Right Ventricle
 -> Lungs
 -> Left Atrium
 -> Left Ventricle

 -> Right Ventricle
 -> Right Atrium
 -> Right Ventricle
 -> Lungs
 -> Left Atrium
 -> Left Ventricle
```

```
-> Bones
-> Right Atrium
-> Right Ventricle
-> Lungs
-> Left Atrium
-> Left Ventricle

-> Skin
-> Right Atrium
-> Right Ventricle
-> Lungs
-> Left Atrium
-> Left Ventricle

-> Brain
-> Right Atrium
-> Right Ventricle
-> Lungs
-> Left Atrium
-> Left Ventricle

-> Skeletal Muscle
-> Right Atrium
-> Right Ventricle
-> Lungs
-> Left Atrium
-> Left Ventricle

-> Kidneys
-> Right Atrium
-> Right Ventricle
-> Lungs
-> Left Atrium
-> Left Ventricle

-> Gastro-Intestinal System & Spleen
-> Right Atrium
-> Right Ventricle
-> Lungs
-> Left Atrium
-> Left Ventricle

-> Liver
The platelet Cell with cell ID 29 is destroyed
A new platelet Cell gets produced
```

Choice 3 : How WBC Cells Travels through the Human Body

```
The White Blood Cell with cell ID 1 visited

-> Right Ventricle

-> Lungs

-> Left Atrium

-> Left Ventricle

-> Heart Muscle

-> Right Atrium
-> Right Ventricle
-> Lungs
-> Left Atrium
-> Left Ventricle

-> Bones
-> Right Atrium
-> Right Ventricle
-> Lungs
-> Left Atrium
-> Left Ventricle

-> Skin
-> Right Atrium
-> Right Ventricle
-> Lungs
-> Left Atrium
-> Left Ventricle

-> Brain
-> Right Atrium
-> Right Ventricle
-> Lungs
-> Left Atrium
-> Left Ventricle
```

```
-> Brain
-> Right Atrium
-> Right Ventricle
-> Lungs
-> Left Atrium
-> Left Ventricle

-> Skeletal Muscle
-> Right Atrium
-> Right Ventricle
-> Lungs
-> Left Atrium
-> Left Ventricle

-> Kidneys
-> Right Atrium
-> Right Ventricle
-> Lungs
-> Left Atrium
-> Left Ventricle

-> Gastro-Intestinal System & Spleen

-> Liver
-> Right Atrium
-> Right Ventricle
-> Lungs
-> Left Atrium
-> Left Ventricle

-> Other
-> Right Atrium
-> Right Ventricle
-> Lungs
-> Left Atrium
-> Left Ventricle

Would you want to see the remaining 6 White Black cells traverse through the body? YES - Y | NO - N : N
```

Choice 4 : How RBC Cells Travels through the Human Body (SIMILAR AS ABOVE)

```
The Red Blood Cell with cell ID 1 visited

 -> Right Ventricle

 -> Lungs

 -> Left Atrium

 -> Left Ventricle

 -> Heart Muscle

 -> Right Atrium
 -> Right Ventricle
 -> Lungs
 -> Left Atrium
 -> Left Ventricle

 -> Bones
 -> Right Atrium
 -> Right Ventricle
 -> Lungs
 -> Left Atrium
 -> Left Ventricle

 -> Skin
 -> Right Atrium
 -> Right Ventricle
 -> Lungs
 -> Left Atrium
 -> Left Ventricle

 -> Brain
 -> Right Atrium
 -> Right Ventricle
 -> Lungs
 -> Left Atrium
 -> Left Ventricle
```

```
 -> Brain
 -> Right Atrium
 -> Right Ventricle
 -> Lungs
 -> Left Atrium
 -> Left Ventricle

 -> Skeletal Muscle
 -> Right Atrium
 -> Right Ventricle
 -> Lungs
 -> Left Atrium
 -> Left Ventricle

 -> Kidneys
 -> Right Atrium
 -> Right Ventricle
 -> Lungs
 -> Left Atrium
 -> Left Ventricle

 -> Gastro-Intestinal System & Spleen

 -> Liver
 -> Right Atrium
 -> Right Ventricle
 -> Lungs
 -> Left Atrium
 -> Left Ventricle

 -> Other
 -> Right Atrium
 -> Right Ventricle
 -> Lungs
 -> Left Atrium
 -> Left Ventricle

Would you want to see the remaining 35 Red Black cells traverse through the body? YES - Y | NO - N : N

Would you like to see what happens after 120 days?   YES - Y | NO - N : N
```

Choice 5 : Profiling Information

```
                                PROFILE INFORMATION ON A RED BLOOD CELL
-------------------------------------------------------------------------------------------------------------------

The average life span of a RBC - 120 days.
Number of RBC cells in this individual - 7470024 million cells.
Number of traversals per life span - 2880
Average traversal time of a RBC - 60 seconds.

                Flowrates when entering different organs.

The flowrate of a RBC Cell passing through the Right Ventricle is 2.53509
The flowrate of a RBC Cell passing through the Right Atrium is 2.53509
The flowrate of a RBC Cell passing through the Left Atrium is 2.53509
The flowrate of a RBC Cell passing through the Left Ventricle is 2.53509
The flowrate of a RBC Cell passing through the Lungs is 2.53509
The flowrate of a RBC Cell passing through the Heart Muscle is 0.0760526
The flowrate of a RBC Cell passing through the Bones is 0.126754
The flowrate of a RBC Cell passing through the Skin is 0.152105
The flowrate of a RBC Cell passing through the Brain is 0.354912
The flowrate of a RBC Cell passing through the Skeletal Muscle is 0.380263
The flowrate of a RBC Cell passing through the Kidneys is 0.557719
The flowrate of a RBC Cell passing through the Gastro-Intestinal System & Spleen is 0.532368
The flowrate of a RBC Cell passing through the Liver is 0.152105
The flowrate of a RBC Cell passing through the Other is 0.202807

                Probabilities of entering different organs.

The probability of a Red Blood Cell entering the Right Ventricle is 2.35104e-312 %
The probability of a Red Blood Cell entering the Right Atrium is 2.35104e-312 %
The probability of a Red Blood Cell entering the Left Atrium is 2.35104e-312 %
The probability of a Red Blood Cell entering the Left Ventricle is 2.35104e-312 %
The probability of a Red Blood Cell entering the Lungs is 2.35104e-312 %
The probability of a Red Blood Cell entering the Heart Muscle is 7.05312e-314 %
The probability of a Red Blood Cell entering the Bones is 1.17552e-313 %
The probability of a Red Blood Cell entering the Skin is 1.41062e-313 %
The probability of a Red Blood Cell entering the Brain is 3.29146e-313 %
```

```
                                    PROFILE INFORMATION ON A PLATELET CELL
-------------------------------------------------------------------------------------------------------------------------

The average life span of a Platelet Cell - 10 days.
Number of Platelet Cells in this individual - 43 million cells.
Number of traversals per life span - 240
Average traversal time of a Platelet Cell - 60 seconds.

                 Flowrates when entering different organs.

The flowrate of a platelet Cell passing through the Right Ventricle is 3.39917e-318
The flowrate of a platelet Cell passing through the Right Atrium is 3.39917e-318
The flowrate of a platelet Cell passing through the Left Atrium is 3.39917e-318
The flowrate of a platelet Cell passing through the Left Ventricle is 3.39917e-318
The flowrate of a platelet Cell passing through the Lungs is 3.39917e-318
The flowrate of a platelet Cell passing through the Heart Muscle is 1.03754e-319
The flowrate of a platelet Cell passing through the Bones is 1.67982e-319
The flowrate of a platelet Cell passing through the Skin is 2.02567e-319
The flowrate of a platelet Cell passing through the Brain is 4.74303e-319
The flowrate of a platelet Cell passing through the Skeletal Muscle is 5.08888e-319
The flowrate of a platelet Cell passing through the Kidneys is 7.46039e-319
The flowrate of a platelet Cell passing through the Gastro-Intestinal System & Spleen is 7.11455e-319
The flowrate of a platelet Cell passing through the Liver is 2.02567e-319
The flowrate of a platelet Cell passing through the Other is 2.71736e-319

                 Probabilities of entering different organs.

The probability of a platelet Cell entering the Right Ventricle is 6.24024 %
The probability of a platelet Cell entering the Right Atrium is 6.24024 %
The probability of a platelet Cell entering the Left Atrium is 6.24024 %
The probability of a platelet Cell entering the Left Ventricle is 6.24024 %
The probability of a platelet Cell entering the Lungs is 6.24024 %
The probability of a platelet Cell entering the Heart Muscle is 0.187207 %
The probability of a platelet Cell entering the Bones is 0.312012 %
The probability of a platelet Cell entering the Skin is 0.374414 %
The probability of a platelet Cell entering the Brain is 0.873634 %
The probability of a platelet Cell entering the Skeletal Muscle is 0.936036 %
The probability of a platelet Cell entering the Kidneys is 1.37285 %
The probability of a platelet Cell entering the Gastro-Intestinal System & Spleen is 1.31045 %
The probability of a platelet Cell entering the Liver is 0.374414 %
The probability of a platelet Cell entering the Other is 0.499219 %
```

```
                                    PROFILE INFORMATION ON A WHITE BLOOD CELL
-------------------------------------------------------------------------------------------------------------------------

The average life span of a WBC - 15 days.
Number of WBC cells in this individual - 9110664 million cells.
Number of traversals per life span - 360
Average traversal time of a WBC - 60 seconds.

                Flowrates when entering different organs.

The flowrate of a WBC Cell passing through the Right Ventricle is 0.00422501
The flowrate of a WBC Cell passing through the Right Atrium is 0.00422501
The flowrate of a WBC Cell passing through the Left Atrium is 0.00422501
The flowrate of a WBC Cell passing through the Left Ventricle is 0.00422501
The flowrate of a WBC Cell passing through the Lungs is 0.00422501
The flowrate of a WBC Cell passing through the Heart Muscle is 0.00012675
The flowrate of a WBC Cell passing through the Bones is 0.00021125
The flowrate of a WBC Cell passing through the Skin is 0.0002535
The flowrate of a WBC Cell passing through the Brain is 0.000591501
The flowrate of a WBC Cell passing through the Skeletal Muscle is 0.000633751
The flowrate of a WBC Cell passing through the Kidneys is 0.000929501
The flowrate of a WBC Cell passing through the Gastro-Intestinal System & Spleen is 0.000887251
The flowrate of a WBC Cell passing through the Liver is 0.0002535
The flowrate of a WBC Cell passing through the Other is 0.000338001

                Probabilities of entering different organs.

The probability of a White Blood Cell entering the Right Ventricle is 3.69082e-312 %
The probability of a White Blood Cell entering the Right Atrium is 3.69082e-312 %
The probability of a White Blood Cell entering the Left Atrium is 3.69082e-312 %
The probability of a White Blood Cell entering the Left Ventricle is 3.69082e-312 %
The probability of a White Blood Cell entering the Lungs is 3.69082e-312 %
The probability of a White Blood Cell entering the Heart Muscle is 1.10725e-313 %
The probability of a White Blood Cell entering the Bones is 1.84541e-313 %
The probability of a White Blood Cell entering the Skin is 2.21449e-313 %
The probability of a White Blood Cell entering the Brain is 5.16715e-313 %
The probability of a White Blood Cell entering the Skeletal Muscle is 5.53623e-313 %
The probability of a White Blood Cell entering the Kidneys is 8.11981e-313 %
The probability of a White Blood Cell entering the Gastro-Intestinal System & Spleen is 7.75072e-313 %
The probability of a White Blood Cell entering the Liver is 2.21449e-313 %
The probability of a White Blood Cell entering the Other is 2.95266e-313 %
```