Douglas Bag Gas Analyser Documentation

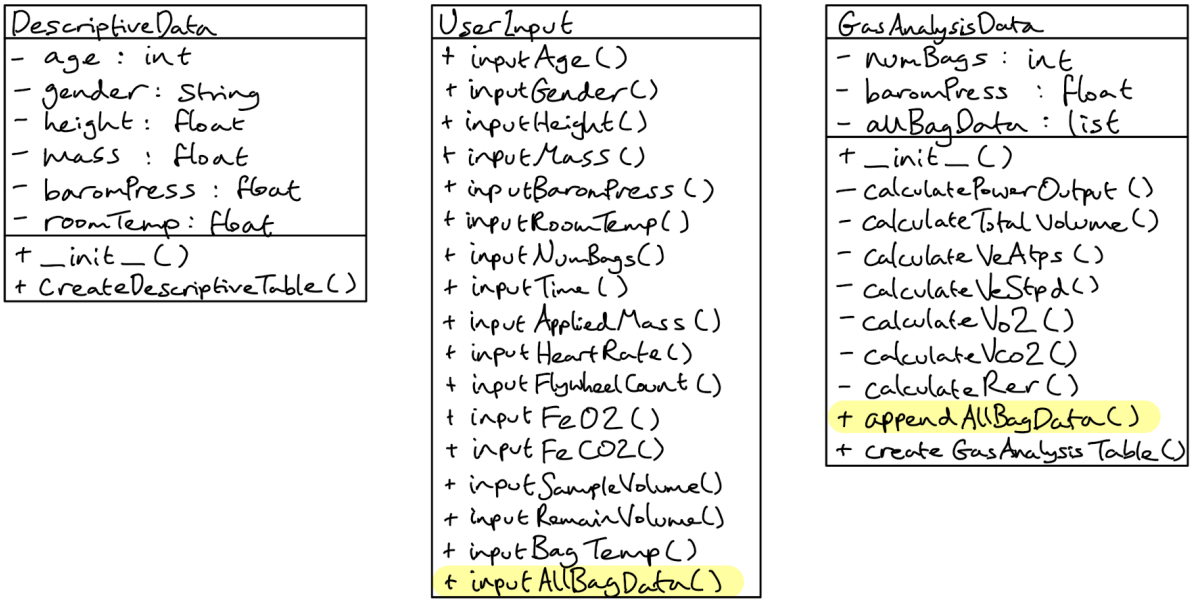
Overview

Functionality

1. Prompts the user to input descriptive data
    - Age (yrs)
    - Gender (M/F)
    - Height (m)
    - Mass (kg)
    - Barometric pressure (mmHg)
    - Room temperature (℃)
2. Prompts the user to input how many Douglas Bags they would like to record
3. Prompts the user to input Douglas Bag data collected from the laboratory equipment
    - Number of loops is determined by the number inputted in step 2 (number of Douglas Bags the user wants to record)
        i. Collection time (s)
        ii. Applied mass (kg)
        iii. Heart rate (bpm)
        iv. Flywheel count
        v. FEO_2 (%)
        vi. $FECO_2$ (%)
        vii. Sample volume during gas analysis (L)
        viii. Remaining volume in Douglas Bag (L)
        ix. Bag temperature (℃)
4. Calculates gas analysis data for the data inputted
    - Number of loops is determined by the number inputted in step 2 (number of Douglas Bags the user wants to record)
        i. Power output (W)
        ii. Total bag volume (L)
        iii. VE ATPS (L min^{-1})
        iv. VE STPD (L min^{-1})
        v. Absolute VO_2 (L min^{-1})
        vi. Absolute VCO_2 (L min^{-1})
        vii. RER
5. Displays the descriptive data in a table using Python Tabulate
6. Displays the gas analysis data in a table using Python Tabulate

Designs and Plans

Class Diagram



Flow of the Program

1. Create a new “UserInput” object
2. Call all the methods needed to prompt the user to input descriptive data and store the values in variables
    a. “inputAge()”
    b. “inputGender()”
    c. “inputHeight()”
    d. “inputMass()”
    e. “inputBaromPress()”
    f. “inputRoomTemp()”
3. Create a new “DescriptiveData” object where the parameters for the “__init__()” function are all the descriptive data inputs stored in their respective variables (from step 2)
    a. The “__init__()” function assigns the input values to their respective attributes
4. Call the “inputNumBags” method to prompt the user to input the number of Douglas Bags they want to record and store the value in a variable
5. Call the “inputAllBagData()” method to prompt the user to input data collected from the Douglas Bag equipment

    a. The parameter for the “inputAllBagData()” method is the number of Douglas Bags to record (from step 4)
    b. The “inputAllBagData()” method loops for the number of Douglas Bags to record (from step 4)
    c. The “inputAllBagData()” method further calls methods within the same “UserInput” class
        i. “inputTime()”
        ii. “inputAppliedMass()”
        iii. “inputHeartRate()”
        iv. “inputFlywheelCount()”
        v. “inputFe02”
        vi. “inputFeCO2()”
        vii. “inputSampleVolume()”
        viii. “inputRemainVolume()”
        ix. “inputBagVolume()”
    d. The “inputAllBagData()” method store all the inputs in a 2D array where each sub-array represents the specific Douglas Bag
6. Create a new “GasAnalysisData” object where the parameters for the “__init__()” function are the number of Douglas Bags to record (from step 4), the barometric pressure (from step 2) and the data collected from the Douglas Bag equipment (from step 5) in their respective variables
    a. The “__init__()” function assigns the values to their respective attributes
7. Call the “appendAllBagData()” method to calculate Douglas Bag values to be calculated (such as VO_2)
    a. The “appendAllBagData()” method loops for the number of Douglas Bags to record (from step 4)
    b. The “appendAllBagData()” method further calls methods within the same “GasAnalysisData” class
        i. “calculatePowerOutput()”
        ii. “calculateVeAtps()”
        iii. “calculateVeStpd()”
        iv. “calculateVo2()”
        v. “calculateVco2()”
        vi. “calculateRer()”
    c. The “appendAllBagData()” method appends the calculated values to the already existing “allBagData” 2D array where each sub-array represents the specific Douglas Bag
8. Call the “createDescriptiveTable()” and “createGasAnalysisTable()” methods to display the descriptive data and gas analysis data in a table

Testing and Results

Test Case 1: One Douglas Bag

```
Please enter your age (yrs): 19
Please enter your gender (M/F): M
Please enter your height (m): 1.8
Please enter your mass (kg): 77.5
Please enter the barometric pressure (mmHg): 752.31
Please enter the room temperature (C): 19
Please enter the number of Douglas Bags you would like to record: 1

Douglas Bag 1:
Please enter the time in seconds this Douglas Bag was sampled (s): 60
Please enter the applied mass for this Douglas Bag sample (kg): 1.0
Please enter the average HR for this Douglas Bag sample (bpm): 109
Please enter the flywheel count for this Douglas Bag sample: 193
Please enter the FEO2 for this Douglas Bag sample (%): 16.54
Please enter the FECO2 for this Douglas Bag sample (%): 4.28
Please enter the sample volume during gas analysis for this Douglas Bag sample (L): 1.8
Please enter the remaining volume in the Douglas Bag for this Douglas Bag sample (L): 32.3
Please enter the Douglas Bag temperature for this Douglas Bag sample (C): 19.9
```

Descriptive data:

Age (yrs)	Gender (M/F)	Height (m)	Mass (kg)	Barometric Pressure (mmHg)	Room Temperature (C)
19	M	1.8	77.5	752.31	19

Gas analysis data:

Data	Bag 1
Time (s)	60
Applied Mass (kg)	1
Heart Rate (bpm)	109
Flywheel Count	193
FEO2 (%)	16.54
FECO2 (%)	4.28
Sample Volume (L)	1.8
Remaining Volume (L)	32.3
Bag Temperature (C)	19.9
Power Output (W)	51.18
Total Bag Volume (L)	34.1
VE ATPS (L/min)	34.1
VE STPD (L/min)	30.8
VO2 (L/min)	1.36
VCO2 (L/min)	1.31
RER	0.96

Test Case 2: Two Douglas Bags

```
Please enter your age (yrs): 19
Please enter your gender (M/F): M
Please enter your height (m): 1.8
Please enter your mass (kg): 77.5
Please enter the barometric pressure (mmHg): 752.31
Please enter the room temperature (C): 19
Please enter the number of Douglas Bags you would like to record: 2

Douglas Bag 1:
Please enter the time in seconds this Douglas Bag was sampled (s): 60
Please enter the applied mass for this Douglas Bag sample (kg): 1.0
Please enter the average HR for this Douglas Bag sample (bpm): 109
Please enter the flywheel count for this Douglas Bag sample: 193
Please enter the FEO2 for this Douglas Bag sample (%): 16.54
Please enter the FECO2 for this Douglas Bag sample (%): 4.28
Please enter the sample volume during gas analysis for this Douglas Bag sample (L): 1.8
Please enter the remaining volume in the Douglas Bag for this Douglas Bag sample (L): 32.3
Please enter the Douglas Bag temperature for this Douglas Bag sample (C): 19.9

Douglas Bag 2:
Please enter the time in seconds this Douglas Bag was sampled (s): 60
Please enter the applied mass for this Douglas Bag sample (kg): 1.5
Please enter the average HR for this Douglas Bag sample (bpm): 120
Please enter the flywheel count for this Douglas Bag sample: 211
Please enter the FEO2 for this Douglas Bag sample (%): 15.92
Please enter the FECO2 for this Douglas Bag sample (%): 4.50
Please enter the sample volume during gas analysis for this Douglas Bag sample (L): 1.8
Please enter the remaining volume in the Douglas Bag for this Douglas Bag sample (L): 32.4
Please enter the Douglas Bag temperature for this Douglas Bag sample (C): 19.7
```

Descriptive data:

Age (yrs)	Gender (M/F)	Height (m)	Mass (kg)	Barometric Pressure (mmHg)	Room Temperature (C)
19	M	1.8	77.5	752.31	19

Gas analysis data:

Data	Bag 1	Bag 2
Time (s)	60	60
Applied Mass (kg)	1	1.5
Heart Rate (bpm)	109	120
Flywheel Count	193	211
FEO2 (%)	16.54	15.92
FECO2 (%)	4.28	4.5
Sample Volume (L)	1.8	1.8
Remaining Volume (L)	32.3	32.4
Bag Temperature (C)	19.9	19.7
Power Output (W)	51.18	83.93
Total Bag Volume (L)	34.1	34.2
VE ATPS (L/min)	34.1	34.2
VE STPD (L/min)	30.8	30.92
VO2 (L/min)	1.36	1.59
VCO2 (L/min)	1.31	1.38
RER	0.96	0.87

Test Case 3: Three Douglas Bags

```
Please enter your age (yrs): 19
Please enter your gender (M/F): M
Please enter your height (m): 1.8
Please enter your mass (kg): 77.5
Please enter the barometric pressure (mmHg): 752.31
Please enter the room temperature (C): 19
Please enter the number of Douglas Bags you would like to record: 3

Douglas Bag 1:
Please enter the time in seconds this Douglas Bag was sampled (s): 60
Please enter the applied mass for this Douglas Bag sample (kg): 1.0
Please enter the average HR for this Douglas Bag sample (bpm): 109
Please enter the flywheel count for this Douglas Bag sample: 193
Please enter the FEO2 for this Douglas Bag sample (%): 16.54
Please enter the FECO2 for this Douglas Bag sample (%): 4.28
Please enter the sample volume during gas analysis for this Douglas Bag sample (L): 1.8
Please enter the remaining volume in the Douglas Bag for this Douglas Bag sample (L): 32.3
Please enter the Douglas Bag temperature for this Douglas Bag sample (C): 19.9

Douglas Bag 2:
Please enter the time in seconds this Douglas Bag was sampled (s): 60
Please enter the applied mass for this Douglas Bag sample (kg): 1.5
Please enter the average HR for this Douglas Bag sample (bpm): 120
Please enter the flywheel count for this Douglas Bag sample: 211
Please enter the FEO2 for this Douglas Bag sample (%): 15.92
Please enter the FECO2 for this Douglas Bag sample (%): 4.50
Please enter the sample volume during gas analysis for this Douglas Bag sample (L): 1.8
Please enter the remaining volume in the Douglas Bag for this Douglas Bag sample (L): 32.4
Please enter the Douglas Bag temperature for this Douglas Bag sample (C): 19.7

Douglas Bag 3:
Please enter the time in seconds this Douglas Bag was sampled (s): 60
Please enter the applied mass for this Douglas Bag sample (kg): 2.0
Please enter the average HR for this Douglas Bag sample (bpm): 134
Please enter the flywheel count for this Douglas Bag sample: 227
Please enter the FEO2 for this Douglas Bag sample (%): 15.91
Please enter the FECO2 for this Douglas Bag sample (%): 4.69
Please enter the sample volume during gas analysis for this Douglas Bag sample (L): 1.8
Please enter the remaining volume in the Douglas Bag for this Douglas Bag sample (L): 42.0
Please enter the Douglas Bag temperature for this Douglas Bag sample (C): 19.6
```

Descriptive data:

Age (yrs)	Gender (M/F)	Height (m)	Mass (kg)	Barometric Pressure (mmHg)	Room Temperature (C)
19	M	1.8	77.5	752.31	19

Gas analysis data:

Data	Bag 1	Bag 2	Bag 3
Time (s)	60	60	60
Applied Mass (kg)	1	1.5	2
Heart Rate (bpm)	109	120	134
Flywheel Count	193	211	227
FEO2 (%)	16.54	15.92	15.91
FECO2 (%)	4.28	4.5	4.69
Sample Volume (L)	1.8	1.8	1.8
Remaining Volume (L)	32.3	32.4	42
Bag Temperature (C)	19.9	19.7	19.6
Power Output (W)	51.18	83.93	120.4
Total Bag Volume (L)	34.1	34.2	43.8
VE ATPS (L/min)	34.1	34.2	43.8
VE STPD (L/min)	30.8	30.92	39.62
VO2 (L/min)	1.36	1.59	2.03
VCO2 (L/min)	1.31	1.38	1.85
RER	0.96	0.87	0.91