

CS 109 – C/C ++ Programming for Engineers w. MatLab– Fall 2009

Homework Assignment 2

Tables of Gas Mixture Partial Pressures

Due: Tuesday 22 September, 11:59 p.m., via Blackboard. Hard copy to be handed in during lab **MUST MATCH THE ELECTRONIC COPY EXACTLY.**

Overall Assignment

This assignment expands on the previous assignment by using loops and decision making to construct a table of partial pressures of oxygen for different percentages of oxygen in a diver's gas mixture and for different depths.

Background: SCUBA, Nitrox, and Gas Partial Pressure Calculations

See homework 1.

Program Details

For this assignment, you are to write a program that constructs a table of partial pressures of oxygen for a diver breathing a given blend of Nitrox at a given depth, as well as the maximum operating depth (MOD) to which the diver can dive while breathing that gas mixture.

- Your program should first print out your name and ID, and explain to the user what the program does.
- Your program should then ask the user for the range of oxygen percentages and the range of depths to be covered by the table. Each range consists of a minimum value, a maximum value, and an increment, so there would be six numbers to read in all together. (Your program should ask for each number individually.) Check the data entered to verify that it is valid, using do-while loops.
- Your program should produce a table with depths down the left side, percentages of oxygen across the top, and the partial pressure of oxygen for that mixture at that depth within the table.
 - The table should contain a column labeled “Air” for 21% oxygen. For the base assignment make this the first column in the table.
 - If the partial pressure of oxygen is above 1.4, print the word “DANGER” instead of a number.
 - At the bottom of the table, print a row of dashes (using a loop), and then an extra row labeled “MOD”. The values printed on that row should be the maximum operating depth for that percentage gas mixture. (MODs should be truncated down to the next lower integer value.)
 - The table should be formatted “nicely”, with decimal points lined up, etc., and properly labeled across the top.

Sample Output

The following is a partial table for a depth range from 20 to 140 feet by 10 foot increments, for oxygen percentages from 30 to 40% by 2% increments. The data is deliberately left incomplete. You may improve upon this format if you wish.

| Depth | Percentage Oxygen | | | | | | |
|-------|-------------------|------|------|------|--------|--------|--------|
| | Air | 30% | 32% | 34% | 36% | 38% | 40% |
| 20 | 0.34 | 0.48 | 0.51 | 0.55 | 0.58 | 0.61 | 0.64 |
| 30 | | | | | | | |
| 40 | | | | | | | |
| 50 | | | | | | | |
| 60 | | | | | | | |
| 70 | | | | | | | |
| 80 | | | | | | | |
| 90 | | | | | | | |
| 100 | 0.85 | 1.21 | 1.29 | 1.37 | DANGER | DANGER | DANGER |
| 110 | | | | | | | |
| 120 | | | | | | | |
| 130 | | | | | | | |
| 140 | | | | | | | |

| | | |
|-----|-----|----|
| MOD | 114 | 97 |
|-----|-----|----|

What to Hand In:

1. Your code, **including a readme file**, should be handed in electronically using Blackboard.
2. The purpose of the readme file is to make it as easy as possible for the grader to understand your program. If the readme file is too terse, then (s)he can't understand your code; If it is overly verbose, then it is extra work to read the readme file. It is up to you to provide the most effective level of documentation.
3. If there are problems that you know your program cannot handle, it is best to document them in the readme file, rather than have the TA wonder what is wrong with your program.
4. Make sure that your name appears at the beginning of each of your files. Your program should also print this information when it runs.

Optional Enhancements:

It is course policy that students may go above and beyond what is called for in the base assignment if they wish. These optional enhancements will not raise any student's score above 100 for any given assignment, but they may make up for points lost due to other reasons.

- If the table includes a column for 21% oxygen, then label that column "Air" and keep it in its normal location, INSTEAD OF putting "Air" in the first column. (E.g. this would apply for a table from 15 to 25% by 1% increments, but not one from 15 to 40% by 5% .)
- Equivalent Air Depth, EAD, is the depth that a diver breathing air would experience the same partial pressure as a diver breathing Nitrox at a different depth. For example, a diver breathing 32% Nitrox at 100 feet has an EAD of 81 feet, as both have a P_{O_2} of 1.29 atm. EAD could be added to this table or provided in a separate table.
- Other enhancements that you think of – Check with TA for acceptability.