MIDDLE EAST TECHNICAL UNIVERSITY, NORTHERN CYPRUS CAMPUS
CNG140 C Programming Assignment 4

Date handed out: **6 May 2015, Wednesday**
Date submission due: **20 May 2015, Wednesday, 23:55**

Programming Assignment 4: AfG Scheduler

Introduction

This assignment aims to help you revise some fundamental topics of C programming. It mainly familiarizes you with arrays, strings, dynamic memory allocation, structures, functions, files and loops. Your main task in this assignment is to write a small C program that solves the scheduling problem for an airlines company.

Programming Use Case

Many operational engineering systems require complex scheduling of people, machines, and supplies to provide a service or produce a product. To schedule a system, one needs to know three things: the resources available to the system, the resources required to provide the desired service, and any constraints on the resources. Many sophisticated algorithms are available to minimize the cost or time required to provide a service. In this programming assignment, we will build a small library of functions useful for solving constrained scheduling problems.

You are head of maintenance scheduling for AfG (Airlines for Geeks). You have **three** crews, with different qualifications as follows:

Crew Number	Skill Level	Cost of Crew Per Hour
0	1	$200
1	2	$300
2	3	$400

Table 1 Crew Details for AfG

Crew 2 is certified to do all levels of maintenance work but costs more per hour than the other crews. Crew 1 can do maintenance work requiring skills 1 and 2 but not skill 3. Crew 0 can do maintenance work only at level 1. You need to schedule the following maintenance:

Aircraft ID	Level of Maintenance	Number of Hours
7899	1	8
3119	1	6
7668	1	4
2324	2	4
1123	2	8
7555	2	4
6789	3	2
7888	3	10

Table 2 Maintenance Requirements of AfG

You need to follow the programming requirements given below to schedule these given maintenance requirements with the three crews defined above.

Programming Requirements:
In this programming assignment, you want to write an open and flexible application therefore your program needs to get the required maintenance schedule (see Table 2) from an external file. You should not make any assumption about the size of the date (i.e., number of rows) included in this external file. However, the data will definitely be in the given format. It will first include the aircraft ID, then the level of maintenance and then the number of hours required for that aircraft for the given level of maintenance.

In your program, you will need to first create an appropriate data structure to represent the crew number and the qualifications (see Table 1). Then you will also need to create an appropriate data structure to represent the maintenance schedule details that will be read from an external file (see Table 2).

As the programming requirements, you need to write a main program that calls the following functions (and any others you feel are needed) for scheduling crews to do the listed maintenance jobs. Assume that all three crews can work at the same time and that the crews are paid only when they work. Jobs must be done in their entirety by one crew.

The overall task in this program is to create one algorithm to find the quickest way to get the maintenance done and another to find the cheapest way to get the work done. Your program needs to report both results. In your source code, you need to also provide the **Pseudocode** of these two algorithms as comments**.** In order to implement these two algorithms you need to define and call the following functions:

`get_crew_data`: A function to scan and store crew data in an appropriate structure.

`check_crew`: A function that checks maintenance level required against the crew abilities and returns the number of the lowest-cost crew that can perform the maintenance.

`check_maintenance_level`: A function that checks the maintenance level required against the crew abilities and current schedule and returns the number of the qualified crew that will be free to perform the maintenance at the earliest time. If more than one crew satisfies the function's constraints, the number of the lowest-cost qualified crew is returned.

`crew_hours_calculator`: A function that accumulates hours required for each crew as each maintenance task is scheduled.

Grading:
Your program will be graded as follows:

Grading Point	**Points (100)**
Define and initialize a structure to represent the crew data	10 pts
Define a dynamic structure to represent the maintenance data	10 pts
One algorithm to find the quickest way to get the maintenance done and another to find the cheapest way to	10 pts

get the work done	
Pseudocode of your algorithms as a comment in your program	5 pts
Initialize the crew data from the file with the `get_crew_data` function	15 pts
`check_crew`	15 pts
`check_maintenance_level`	15 pts
`crew_hours_calculator`	10 pts
Code quality (Appropriate comments, variable names, formulation of selection statements and loops, reusability, extensibility etc.)	10 pts

Please make sure that you follow the restrictions for the assignment as follows.

- **You are not allowed to use global variables**.
- Strictly obey the input output format. Do not print extra things.
- You are not allowed to use `goto` statement.
- Name your source file "AfG.c"
- Upload only source file. Do not compress it (zip, rar, …)