25 February 2011 -- Computer Architectures –- part 1/2

Name, Matricola .....

In 2012 London will host XXX-th Summer Olympic Games. Among the different disciplines there is men 400 m swimming free style in long course (50 m), that accounts, at present day, the world record 3:40.07 by Paul Biedermann from Germany.

It is required to write a 8086 assembly program to manage the standings of the final of men 400 m swimming free style in long course (50 m), where it is well known that 8 athletes will be competing.

At the competition, the chronograph systems produce a list of times of the athletes according to the following format:

Number of athlete on 8 bits + performance time on 16 bits organized in fields as follows:
100^{th} of second on 7 bits, seconds on 6 bits, minutes on 3 bits, where each time field is represented in pure binary.

The code all zeroes for the time stands for an athlete that has been disqualified or who has exceeded the maximum representable time according to this format.

For example:

00000110	0010110	100111	100
athl #6	100^{th} s = 22	s= 39	m= 4

That is, the athlete #6 has got the time 4:39.22

Assume that all athletes & times are found in an unsorted array where for each athlete there are 3 bytes of info, one for the number and the other two for the time according to the format above (such as TIMES DB 8 DUP (?, ?, ?)). Assume that the world record time is stored in a variable WR DW ? according to the same format.

WITHOUT DOING A FLAT CONVERSION OF ALL TIMES INTO 100^{TH} OF SECOND, it is required that:

- Item 1: it is provided another array in the same format as above, with the standings of the competition, from fastest to slowest, e.g. assuming to use the array STANDINGS DB 8 DUP (?, ?, ?), then:
  - STANDINGS[0] stores the code of the fastest and STANDINGS[1] and STANDINGS[2] its time (same format as above)
  - STANDINGS[3] stores the code of the second fastest & STANDINGS[4] and STANDINGS[5] its time, and so on
- Item 2: it is provided an array DIFF_PREV DW 8 DUP (?) where it is stored the difference in time (again, same format) between one athlete and the one immediately faster than him. By definition, DIFF_PREV[0] holds 0.
- Item 3: it is provided an array DIFF_FIRST DW 8 DUP (?) where it is stored the difference in time (again, same format) between one athlete and the winner. Clearly, DIFF_FIRST[0] holds 0.
- Item 4: it is computed in the variable DIFF_WR DW ? the difference between the time of the first and the current world record. Clearly, if the winner has got a time better than the world record, this should be clearly managed and given in output (in any case the variable DIFF_WR should hold a positive value in the same format as all times).
- Bonus: management of disqualified athletes according to rules to be clearly stated by the programmer as comment in the program itself.

It is required that all operations are done in the native format. A conversion into all 100^{th} seconds will result in accounting at most 66% of the points for each fully completed item.

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Points for each completed item (as uncompleted items could be not evaluated)
Item 1. = up to 22 points;
Item 2. = up to 4 points;
Item 3. = up to 4 points;
Item 4. = up to 2 points;

Bonus: 1 point (can be accounted only once).

It is not required to provide the optimal (shortest, most efficient, fastest, …) solution, but a working and clear solution. The input-output part is not necessary in the class developed solution, but its implementation is mandatory to be discussed at oral exam.

Please use carbon copy and retain one copy for home implementation and debug. Please provide your classroom submitted solution with several explanatory and significant comments. When coming to oral discussion, please mark on your "classroom" copy all modifications. Please also provide an error-free and running release of the solution, as well as with its printed list of instructions. Please consider that the above are necessary but not sufficient requirements to success the exam, since the final evaluation will be based on a number of parameters.

FAILURE TO ACCOMPLISH ALL PREVIOUS NECESSARY REQUIREMENTS WILL CAUSE NO-QUESTION-ASKED AND IMMEDIATE REJECTION.