Microprocessor Based Systems. Exam of november 7, 2008.

The single votes casted by the 20.000 voting citizens of the United States of Andromeda (which, as everyone knows is made of 51 states) for balloting the President of USAn, have been stored in an array so defined:

VOTES DW N DUP(?) with N EQU 20000

The format of each element of the array is, from MSB to LSB:

- First 1 bit: sex of the voter (=0 for male; =1 for female)
- Next 7 bits: age of the voter, to be added to the base value of 18. Therefore for a person 30 years old, the value 12 is stored here
- Next 6 bits: coding of the state (valid values are from 0 to 50; other values are not possible)
- Last 2 bits: coding of the vote (00= not a valid vote, 01= blank vote, 10= valid vote for candidate 1, 11= valid vote for candidate 2)

Each state of USAn has assigned a number of points, stored in the array

STATES DB 51 DUP(?)

The voting rules of USAn say that for each state, the candidate who gets more votes, wins all the points related to that state. For example, if candidates 1 and 2 get for state 15 (which has assigned 20 points, for example), 23 and 24 votes, respectively, then candidate 2 accounts all the 20 points with candidate 1 receiving no point at all.

Given the two arrays VOTES and STATES, it is mandatory:

1. To determine the winner, i.e. the candidate getting more points.

In addition, it is also required to determine:

A. the overall statistics (in terms of percentages) on the number of votes not valid, blank, for candidate 1 and for candidate 2
B. the same statistics as in point A, but with the detail state by state
C. the same overall statistics as in point A by sex of voters
D. the same overall statistics as in point A for the following ranges of age: 18-25, 26-35, 36-50, 51-70, >70
E. the same statistics as in point A state by state and by sex of voters.

CONSTRAINTS:

- All percentages must be in the form 7 integer bits, plus one fractional
- The array “VOTES” should be scanned no more than one time
- It is advised that the sum of all homogeneous percentages adds up to 100%

EVALUATION (no more than 30 points will be accounted)
Item 1: 18 points
Items A, C: each one 2 points
Items B, D: each one 3 points
Item E: 4 points

Please use carbon copy and retain one copy for home implementation and debug. Please provide in your classroom submitted version several explanatory and significant comments.