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Embedded Systems - Assignment 2

1.
   a) Here is the type of each variable:
      - a: global integer variable
      - b: global integer variable
      - c: global char variable
      - d: global integer variable
      - e: local integer variable, scoped to main
      - f: array of characters, scoped to main

   b) The storage location for each variable is given below:
      - a: global; stored in data memory
      - b: global; stored in data memory
      - c: global; stored in data memory
      - d: global; stored in data memory
      - e: local; stored on stack
      - f: local pointer; stored on stack

2. The output voltage ranges between 0-3. DAC performs with 8 bits. Hence the output resolution in volts can be achieved by:

$$resolution = \frac{Reference\,Voltage}{2^N}$$

   Where N is the number of DAC bits. The answer is $11.71\ mV$.

3. Based on the given information, a 12-bit ADC with a reference voltage of 3.3V has the resolution of 0.8 mV. Meaning that for each 0.8 mV change in the input, the outputs increases one step. A 0.42 V input is 420 mV. Dividing 420 to 0.8 would give us 525 which is equal to 525 steps in the digital domain. 0 is shown as 000000000000 in a 12-bit configuration. Hence 525 steps forward will be 001000001101.

4. An 8-bit ADC with a reference voltage of 2.7V would have a resolution of 10.5 mV. Meaning that for each 10.5 mV shift in the input, the generated digital number increases one step. An output code of 0x34 is equal to the number 52 in the decimal representation. Meaning that 52 shifts have resulted such outputs. Hence the input is 52*10.5 mV = 546 mV. The upper range for the input will be 546 + 10.5, which is 556.5 mV not including the 556.6 mV itself.

5. Dynamic scheduling is a type of scheduling that considers the order and the priority of tasks in runtime. The main goal is to adapt to different kind of processes in the system that may or may not run while the embedded system is turned on. Furthermore, an RTC does not preempt its running tasks until they are finished or at least explicitly yield

control back to the scheduler. Based on this, the scheduler is activated whenever a tasks completes Its running session on the embedded system and returns the handle back to the scheduler.

6. An RTC scheduler decides running of the tasks based on their **running state, priority and availability** respectively regarding their priority. Hence the running task will be completed first. Considering that tasks b and e are not ready after completion of task f, given tasks a, c and d, task a has the highest priority. Task a runs to completion and either of tasks c or d are selected until completion. After completion of c and d, in case of readiness, task b is scheduled because of a higher priority compared with task e. If not ready, task e is scheduled and continues until completion, even if task b pops up in the middle.