Exam 2 objectives (in C) (running uVision in simulation not on real board)
0) During the exam we try to answer questions with “yes”, “no”, “won’t answer”
1) Being able to quickly design, implement, and debug C software
2) Understanding differences between data and address, being able to use pointers and indices
3) Understanding differences between 8-bit, 16-bit data and 32-bit data
4) Understanding differences between signed and unsigned integers
5) Programming if-then if-then-else for-loops while-loops and do-while-loops in C
6) Processing a variable-length array or string, either size first or terminating code at end
7) Addition subtraction multiplication, division, shift, and, or, eor (signed and unsigned)
Handling overflow in C (promote to higher precision, check answer, demote)
8) Structs and Arrays of structs
Access with . format and -> format
9) Call by value, call by reference, return by value
10) Accessing arrays and strings using pointers and indices
   Stepping through two or more arrays at a time
   8/16/32-bit data, signed/unsigned numbers

List of potential programming problems
A) You may be given one or more variable-length arrays of data,
   The size may be the first entry, there may be a termination code, or
   the array may have two fields: size and data
   The data may be 8-bit ASCII characters or integers
   The integers may be 8- or 16-bit or 32-bit, signed or unsigned
   A pointer to this array may be passed to your function
   You may be asked to deal with special cases: size=0, size too big, overflow

B) Your subroutine(s) may be asked to perform operations including, but not limited to these
   Calculating mathematical functions (e.g., \( y = a \cdot x^2 + b \cdot x + c \))
   with ceiling (on overflow, set to max), with floor (on underflow, set to min)
   Determine the size of the array
   Return the first element of the array
   Find the maximum or minimum element in an array
   Find the sum of all the elements
   Find the average of all the elements
   Find the mode of all the elements
   Find the range = maximum - minimum
   Find the maximum or minimum slope (\( \text{buf}[i+1] - \text{buf}[i] \))
   Find the maximum or minimum absolute value
   Count the number of times a particular value occurs (\( \text{buf}[i] == 1000 \))
   Search for the occurrence of one string in another
   Concatenate two strings together
   Delete characters from a string
   Insert one string into another
   Move data from one place to another within an array or string
   Sort the array (we will give the steps)
   Searching a data base made with an array of structs

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Material
1) Book sections 1.3, 1.4, 1.5, 1.6, 5.1, 5.3 (no 5.3.3), 6.1, 6.2, 6.3, 6.4, 6.8
2) Embedded Software in C for an ARM Cortex M
   http://users.ece.utexas.edu/~valvano/embed/toc1.htm
   Chapter 1 Introduction (no I/O, no files, no preprocessor commands)
   Chapter 2 Tokens (no colon, no switch statement)
   Chapter 3 Numbers (no octal)
   Chapter 4 Variables (no statics, no volatile, no externals)
   Chapter 5 Expressions (no selection operator)
   Chapter 6 Flow of control (no switch statements, no goto)
   Chapter 7 Pointers (no FIFO, no I/O)
   Chapter 8 Arrays and strings (no negative index, no string.h functions, no FIFO)
   Chapter 9 Structures (no FSMs, no structs inside structs, no linked lists, no binary trees)
   Chapter 10 Functions (no private functions, no function pointers, no FSM, no linked lists)
3) Labs 1, 2, 3, 4, 5 (in C, no I/O, no SysTick, no PLL, no FSM)
4) Worksheet questions: 4.6, 4.7, 5.6, 5.7, 5.8, 7.3, 8.17

Homework involves old Exam2 problems (not all exams were the same length).
CExam2_StringCompare Easy practice Exam 2 involving ASCII strings
CExam2_Merge Medium difficulty practice Exam 2 involving ASCII strings
CExam2C_CalculusSpring2013 Medium difficulty practice Exam 2 involving Math
CExam2C_PermuteCombine Medium difficulty practice Exam 2 involving Math
CExam2_Unicode Practice Exam 2 involving 8 and 16-bit arrays
CExam2_Mode Practice Exam 2 involving arrays and structures
CExam2_DataBase Practice Exam 2 involving arrays and structures

There are some old FSM exams. However we do not plan to ask FSM this semester, although we
will ask about arrays, structs, and pointers.
CExam2_Moore Practice Exam 2 involving Moore FSM, some C some assembly
CExam2_Mealy Practice Exam 2 involving a Mealy FSM

More study examples: Problems 6.1 to 6.9 in the book.

There will be no SysTick, no I/O initialization, no floating point, no circuits, and no interrupts.

Grading based mostly on numerical results and some part of the grading will be based on
programming style (style to be determined by professor after the exam is given). We consider it
important to actually solve the problem. We reserve the right to give substantially lower grades
to solutions that trick the grader into giving points (hard coding so it returns correct answers
without actually calculating the output from the inputs).

Your laptop needs to be running Keil uVision in simulation and have 75 minutes of power. You
will use the internet to download the exam at the beginning, and then use the internet to upload
the solution to canvas at the end. The instructions for your exam will be very similar to the
practice exams.

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