STUDY GUIDE FOR FINAL EXAM

One double-sided 8½×11" note sheet is permitted during the final exam. Turn in your note sheet with your exam. An ASCII table will be provided if it is necessary. Electronic devices will **not** be allowed.

The final exam is **comprehensive**. Many of the questions will be similar to questions from previous quizzes and exams. Review **Quiz 1, Exam 1, and Exam 2 (+Bonus)**, as well as the **study guides** for the previous exams.

You are responsible for **all** material on the study guides for Exams 1 & 2, as well as the following material covered since Exam 2:

FLOATING-POINT REPRESENTATION & FPU INSTRUCTIONS
(Lectures 35–36; Activity 17)

- *Floating-Point Representation & FPU Instructions – Portions of Sections 12.1–12.2* – Sign, significand (mantissa), and exponent bits. REAL4 and REAL8 data definitions. FINIT, FLD, FST, FSTP; no-operand forms of FADD, FSUB, FMUL, FDIV instructions; FILD, FIST, FISTP instructions; FCOMI and FCOMIP instructions: comparison and use with unsigned jumps; caveats about floating-point arithmetic.
- Examples of question types (not a comprehensive list):
  - Convert a (normalized) single-precision floating point value to decimal.
  - Convert a small rational number (e.g., 0, 2, 4½, –2½) to its single-precision floating-point representation.
  - Code simple computations (e.g., 1.2+3–4*5/6.7) and print the result (*call WriteFloat)*.

HEAP MEMORY & MEMORY MANAGEMENT
(Lecture 37)

- *Section 9.4.1–9.4.3 (Two-Dimensional Arrays) – Assigned Reading (not covered in lecture)* – Row-major vs. column-major ordering. Accessing two-dimensional arrays using base-index and base-index-displacement operands.
- *Heap Memory Allocation (Portions of Section 11.3)* – Static vs. dynamic memory allocation; stack vs. heap; automatic memory management (garbage collection) vs. manual memory management. GetProcessHeap; HeapAlloc; HeapFree; handling errors.
- *Memory Management (Supplemental)* – Real-address mode vs. protected mode; memory-mapped hardware; virtual memory, virtual addresses, page table.
- Examples of question types (not a comprehensive list):
  - Declare a two-dimensional array in a .data section, and write a short program that writes to or reads from a two-dimensional array using base-index or base-index-displacement operands.
  - Be able to answer questions like those marked with a **Q.** in the slides.
  - Write a short program that allocates memory on the heap, writes to/reads from that memory, and frees it, handling errors appropriately.

MEMORY HIERARCHY & CACHE

(Lectures 37–38; Activity 38–39; Reading from Tarnoff)

- Memory hierarchy. Principle of locality; temporal and spatial locality. Cache memory; hits, misses, hit rate, miss rate. Blocks, cache lines; identifying block numbers and offsets from memory addresses. Cache entry = tag + data. Four questions in designing a cache system. Block placement policies: direct-mapped vs. fully associative vs. set-associative; specifics of each policy; why direct-mapped and fully associative are just special cases of set associativity. Replacement policies: LRU, FIFO, LFU, random. Write policies: write-through vs. write-back. Split vs. unified caches. Multilevel caches (L1/L2/L3).
- Examples of question types (not a comprehensive list):
  - Be able to answer questions like those marked with a **Q.** in the slides.
  - The exam will include several questions similar to Activity 18.

Win32 programming (Lab 6) will **not** be on the final exam.

Exam questions will be very similar to questions from **Activities 17 and 18**.