Review for Exam 3

- Interfacing
  - Getting into expanded mode — MODA, MODB, BKGD pins or MODE Register
  - PEAR Register — enable ECLK, LSTRB, R/W on external pins
  - Ports A and B in expanded mode
    - Port A – AD 15-8 (Port A is for data for high byte, even addresses)
    - Port B – AD 7-0 (Port B is for data for low byte, odd addresses)
  - E clock
    - Address on AD 15-0 when E low, Data on AD 15-0 when E high
    - Need to latch address on rising edge of E clock
    - On write (output), external device latches data on signal initiated by falling edge of E
    - On read (input), HC12 latches data on falling edge of E
    - E-clock stretch - MISC register
  - R/W Line
  - LSTRB line
  - Single-byte and two-byte accesses
    - 16-bit access of even address – A0 low, LSTRB low – accesses even and odd bytes
    - 8-bit access of even address – A0 low, LSTRB high – accesses even byte only
    - 8-bit access of odd address – A0 high, LSTRB low – accesses odd byte only
  - Timing – Be sure to meet setup and hold times of device receiving data
    - For a write, meet setup and hold of external device
    - For a read, meet setup and hold of HC12
  - Timing — Be sure to meet address access time (length of time address needs to be on bus before external device is ready)

- SPI
  - Pins used – SCLK, MOSI, MISO, SS
  - Make output pins output with DDRS
  - Difference of use in Master and Slave mode
  - SP0CR1 Register
    - Enable SPI
    - Master or Slave
    - Enable interrupts
    - Clock polarity
    - Clock phase
    - Automatically operate SS for single-byte transfers
    - LSB or MSB first
  - SP0CR2 Register — always 0 (normal mode)
  - SP0BR Register — Set speed (master only)
  - SP0SR Register — SPIF flag - clear by reading SP0SR, the access (read or write) SP0DR
  - SP0DR Register — shift register – master starts transfer by writing data to SP0DR

- A/D Converter
  - How to power-up A/D converter (ATDCTL2)
  - Write 0x01 to ATDCTL4 to set at fastest conversion speed and 8-bit conversions
  - Write 0x81 to ATDCTL4 to set at fastest conversion speed and 10-bit conversions
  - How to set modes of A/D converter (ATDCTL5)
    - 8-channel scan vs. 4-channel scan
    - Continuous Scan vs. Single Scan
    - Multichannel vs. Single Channel conversions
  - How to tell when conversion is complete - ATDSTAT register
  - How to read results of A/D conversions - $\mathrm{ADR}[0-7]\mathrm{H}$ (8-bit conversions)
  - How to read results of A/D conversions - $\mathrm{ADR}[0-7]$ (10-bit conversions)
    - Be able to convert from digital number to voltage, and from voltage to digital number (need to know V_{RH} and V_{RL}).