Practice Exam #1

Students must check the number of pages in this examination paper before beginning to write, and report any discrepancy immediately.

Total marks: 75

Time allowed: 2 hours

Section A (30 marks): For each question in this section, place an X beside all answers that apply. Each question is worth 6 marks. Partial marks are not given for incomplete answers.

Question 1: The unsigned integer 0x8F4 can be represented as:

___ 0b100011110100

___ 0b111110100

___ 02364

___ 0x4F8

___ None of the above

Question 2: When using the DDRD register for Port D configuration:

___ Setting a bit to 1 configures the corresponding pin as an output

___ Reading PIND gives the current state of Port D pins

___ Writing to PORTD affects pull-up resistors when pin is configured as input

___ The register must be configured before using PORTD

___ None of the above

Question 3: Regarding the AVR stack operations:

___ The stack grows toward lower memory addresses

___ push decrements SP after storing a value

___ pop increments SP after retrieving a value

___ SP points to the next free location

___ None of the above

Question 4: In the context of AVR's 8-bit arithmetic:

___ The carry flag is set when there's a carry from bit 7

___ add r16,r16 performs multiplication by 2

___ dec sets the Z flag if the result is zero

___ adc adds the carry flag to the result

___ None of the above

Question 5: For the AVR instruction set:
___ ldi can only be used with registers r16 to r31
___ mov can copy data between any registers
___ sts can store values to any data memory location
___ cp sets the carry flag if the second operand is greater
___ None of the above

Section B (25 marks): Short Answer Questions
Question 6 (5 marks):
Explain how the Z flag in the AVR status register is affected by the CP instruction. Include an example showing specific register values.

Question 7 (5 marks):
Describe the purpose and function of the stack pointer registers SPH and SPL in the AVR architecture. Why are two registers needed?

Question 8 (5 marks):
Compare and contrast the breq and brne instructions in terms of their operation and typical usage scenarios in AVR assembly programs.

Question 9 (5 marks):

Explain how the AVR architecture handles signed versus unsigned arithmetic operations. Use specific instructions as examples.

Question 10 (5 marks):

Describe the relationship between RAMEND and stack initialization in AVR programs. Why is proper stack initialization important?

Section C (20 marks): Programming Problems

Question 11 (8 marks):

Write an AVR assembly function that takes two 8-bit values passed in r16 and r17, and returns their greatest common divisor in r16. Show your complete solution including comments.

Removed Question 12

Question 13 (4 marks):
Write the AVR assembly code to implement the following C statement:
cCopyif(x > 5 && x < 10) y++;
// Assume x is in r16 and y is in r17

Question 14 (2 marks):
Given a string stored in program memory starting at label MESSAGE, write the code to copy it to data memory location 0x200.

Question 15 (2 marks):
Write the code to configure Timer0 in CTC mode with a prescaler of 64.