

## Ch 2 Data Representation Quiz ANS

- Which hex digit corresponds to the 4-bit pattern 1101?
  - 0xB
  - 0xC
  - 0xD
  - 0xEANS: C
- Convert binary 10110 to decimal:
  - 20
  - 22
  - 18
  - 26ANS: C ( $16+4+2=22$ )
- In a 5-bit system, adding unsigned ints 28 and 6 sets which condition?
  - No flags set
  - Carry flag set
  - Overflow flag set
  - Zero flag setANS: B (true sum 34 exceeds  $2^5-1=31$ )
- In a 5-bit system, subtracting unsigned ints 3 - 5 results in which carry/borrow status?
  - Carry=1 (Borrow=0)
  - Carry=0 (Borrow=1)
  - Carry=1 (Borrow=1)
  - Carry=0 (Borrow=0)ANS: B (result  $-2 < 0 \Rightarrow$  borrow; on M3, Carry=NOT Borrow  $\Rightarrow$  C=0)
- On ARM Cortex-M3, the borrow and carry flags relation is:
  - Carry = Borrow
  - Carry = NOT Borrow
  - Borrow always 0
  - Carry always 0ANS: B
- In two's complement,  $TC(x)$  can be obtained by:
  - Invert bits
  - Invert bits and subtract one
  - Invert bits and add one
  - Add one then invert bitsANS: C
- In a 5-bit system, which statement is true about -16 ( $10000_2$ )?
  - Its two's complement is  $00000_2$
  - Its two's complement is itself
  - It cannot be represented
  - It equals +16ANS: B (most negative number maps to itself)
- Signed overflow can occur when:
  - Adding operands with different signs
  - Subtracting operands with the same sign

- C. Adding two negatives
- D. Subtracting a negative from a negative

ANS: C (same-sign add or different-sign subtract can overflow)

9. In CPSR after ADD/SUB, which flag denotes carry?
- A. N
  - B. Z
  - C. C
  - D. V

ANS: C (C for carry)

10. In a 5-bit system, to compute  $a+b$  for  $a=0b10000$  and  $b=0b10000$ , software should check which flag if  $a, b$  are unsigned vs. signed, respectively?
- A. Unsigned $\rightarrow$ V, Signed $\rightarrow$ C
  - B. Unsigned $\rightarrow$ C, Signed $\rightarrow$ V
  - C. Unsigned $\rightarrow$ N, Signed $\rightarrow$ Z
  - D. Unsigned $\rightarrow$ Z, Signed $\rightarrow$ N

ANS: B (unsigned uses C; signed uses V)

**Explanations:** For  $a = 0b10000$  and  $b = 0b10000$  in a 5-bit context, software should check the C flag for unsigned addition and the V flag for signed addition, respectively.

**Unsigned case**

- Treating  $a$  and  $b$  as unsigned 16 and 16, the true sum is 32, which exceeds the 5-bit unsigned max  $2^5-1=31$ ; therefore the carry flag C is set to indicate unsigned overflow.

- Conclusion: check C for unsigned  $a + b$ ;  $C=1$  here because the true result  $> 2^n-1$ .

**Signed case**

- Treating  $a$  and  $b$  as signed  $-16$  and  $-16$  (since  $0b10000$  is the most negative value in 5-bit two's complement), the true sum is  $-32$ , which is below the signed minimum  $-2^4=-16$ ; this sets the overflow flag V for signed overflow.

- Conclusion: check V for signed  $a + b$ ;  $V=1$  here because the true result  $< -2^{n-1}$ .

11. In a 5-bit system, the same binary addition can represent both unsigned  $23+6=29$  and signed  $-9+6=-3$  because:
- A. Adder interprets sign automatically
  - B. Two's complement allows the same hardware; interpretation differs in software
  - C. Hardware selects mode via a pin
  - D. Only subtraction shares hardware

ANS: B

12. For `char str = "ARM Assembly"`, what must the final byte be and what is the string's size in Bytes?
- A. `0x00`; 13
  - B. `0x20`; 12
  - C. `0x41`; 13
  - D. `0x79`; 12 (ASCII hex code for lowercase 'y' is `0x79`)

ANS: A (includes space for NULL terminator; 12 chars + 1 NUL = 13)