L1 Data Representation Quiz ANS

1. Which hex digit corresponds to the 4-bit pattern 1101?
   A. 0xB
   B. 0xC
   C. 0xD
   D. 0xE
   ANS: C

2. Convert 10110_2 to decimal:
   A. 20
   B. 22
   C. 18
   D. 26
   ANS: C (16+4+2=22)

3. In a 5-bit system, adding 28 and 6 sets which condition?
   A. No flags set
   B. Carry flag set
   C. Overflow flag set
   D. Zero flag set
   ANS: B (true sum 34 exceeds $2^5-1=31$)

4. In a 5-bit system, 3 − 5 results in which carry/borrow status?
   A. Carry=1 (Borrow=0)
   B. Carry=0 (Borrow=1)
   C. Carry=1 (Borrow=1)
   D. Carry=0 (Borrow=0)
   ANS: B (result $-2 < 0 \Rightarrow$ borrow; on M3, Carry=NOT Borrow $\Rightarrow$ C=0)

5. On ARM Cortex-M3, the borrow and carry flags relation is:
   A. Carry = Borrow
   B. Carry = NOT Borrow
   C. Borrow always 0
   D. Carry always 0
   ANS: B

6. In two's complement, TC(x) can be obtained by:
   A. Invert bits
   B. Invert bits and subtract one
   C. Invert bits and add one
   D. Add one then invert bits
   ANS: C

7. In a 5-bit system, which statement is true about −16 (10000_2)?
   A. Its two's complement is 00000_2
   B. Its two's complement is itself
   C. It cannot be represented
   D. It equals +16
   ANS: B (most negative number maps to itself)

8. Signed overflow can occur when:
   A. Adding operands with different signs
   B. Subtracting operands with the same sign

C. Adding two negatives
D. Subtracting a negative from a negative never overflows

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→V, Signed→C
B. Unsigned→C, Signed→V
C. Unsigned→N, Signed→Z
D. Unsigned→Z, Signed→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)