1. Convert the following decimal numbers into 8-bit binary numbers in two’s-complement notation.

\[-21, 32, 126, -17, 48\]

2. Convert the following 8-bit binary numbers, which are in two’s complement form, into decimal.

\[10111010, 11100111, 01001010, 00010001, 00101100\]

3. Convert the following numbers from hexadecimal into binary. These are unsigned numbers of arbitrary size.

\[A14, C0, D2E, FB349, 5678\]
4. Give truth tables for the following logical expressions. Make sure I can find your answer without any confusion.

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<thead>
<tr>
<th>p</th>
<th>q</th>
<th>r</th>
<th>((p \rightarrow r) \land (q \rightarrow r))</th>
<th>(r \land \neg (p \lor q))</th>
<th>(p \leftrightarrow (q \land \neg r))</th>
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5. Which of the following are propositions? Write Yes or No in the blank provided.

   a.______ One is bigger than two.
   b.______ Your clothes will never be cleaner than with jiffy wash!
   c.______ Help!
   d.______ I’m being chased by a big black monster!
   e.______ I want that dog is home.
   f.______ Is two bigger than four?
   g.______ If I were a rich man, I’d buy a new horse.
   h.______ Stand up for your country!
   i.______ I saw the moon turn blood red.
   j.______ Everybody likes to sing.
6. Prove the following.

\[ A \cap B \cap C \subseteq (A \cap B) \cup (A \cap C) \]

7. Let \( U = \{0,1,2,3,4,5,6,7,8,9\} \), \( A = \{1,3,5,7,9\} \), \( B = \{0,2,4,6,8\} \), \( C = \{1,4,7\} \), \( D = \{0,4,6,8,9\} \). List the contents of the following sets. Use \( \phi \) for the empty set.

a. \( A \cup C \)

b. \( A \cap B \)

c. \( B \cap D \)

d. \( A - C \)

e. \( D' \)
8. Which of the following statements are true?

_______ a. If 2=3 then 7=97.
_______ b. If 2<3 then 100>10
_______ c. If 30>3 then George Washington was the first president.
_______ d. If “shoe” is a color then “red” is a flavor.
_______ e. If 6+7=13 then 6-7=12.

9. Given the base set S={0,1,2,3,4,5,6,7,8,9,10,11,12,13,14,15} which of the following relations, R, are reflexive, transitive, symmetric or anti-symmetric? Mark an X in the appropriate box if the given relation has the property.

a. \((x, y) \in R\) if and only if \(x - y\) is a multiple of 3. (Note that 0, and -3 are multiples of 3.)

b. \((x, y) \in R\) if and only if the binary representation of y has more 1’s than the binary representation of x.

c. \(\{(1,1),(2,2),(3,3),(1,2),(2,1),(1,3),(3,1),(2,3),(3,2)\}\)

d. \((x, y) \in R\) if and only if \((x < 7 \land y < 7)\) or \((x \geq 7 \land y \geq 7)\).

e. \(\{(1,2),(2,3),(1,3),(4,5),(5,4),(5,5),(4,4)\}\)

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<tr>
<th>Relation</th>
<th>Reflexive</th>
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<th>Transitive</th>
<th>Antisymmetric</th>
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10. Is the following inference correct or incorrect? Prove your result.

\[ p \rightarrow q \]
\[ q \rightarrow p \]
\[ \sim p \]
\[ \sim q \]