1. In a class of 30, 18 study French, 15 study German and 7 study both. How many study neither?

   _____

2. Convert binary 1101 to decimal.

   _____

3. In binary, what is 1 + 1?

   _____

4. Which are required for a sequence of steps to be an algorithm? Choose all that apply.

   ☐ Each step is unambiguous

   ☐ It terminates

   ☐ It is written in a programming language

   ☐ It is finite

   Tick every correct option.

5. In a simple undirected graph without loops, four edges meet a vertex. What is its degree?

   _____

6. In the same class, how many study French only?

   _____

7. Write decimal 10 in binary.

   _____

8. How many rows does a truth table with three inputs have?

   _____

9. For an already sorted million-item list, approximately how many middle-value comparisons can binary search need in the worst case?

   ☐ About twenty

   ☐ One

   ☐ A million

   ☐ A thousand

10. In a connected undirected network with strictly positive edge costs, why does a minimum-cost connected subgraph spanning all vertices contain no cycle?

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☐ A cycle contains an edge you could remove and still reach everywhere

☐ Cycles are hard to draw

☐ It might, depending on the weights

1. **4**

   $18 + 15 - 7 = 26$ study at least one, so $30 - 26 = 4$ study neither.

2. **13**

   Places 8, 4, 2, 1 with digits 1, 1, 0, 1 gives $8 + 4 + 0 + 1 = 13$.

3. **10**

   There is no digit for two, so it carries – the same rule as $9 + 1$ in decimal.

4. **Each step is unambiguous; It terminates; It is finite**

   A procedure solving the stated finite task needs unambiguous steps, correct results and termination on allowed inputs. Pseudocode and flowcharts are representations, not requirements to use a particular programming language.

5. **4**

   Its degree is 4, the number of incident edges under the stated graph convention.

6. **11**

   $18 - 7 = 11$. Filling the Venn diagram from the middle outwards never double-counts.

7. **1010**

   8 and 2 are used, 4 and 1 are not. Writing the place values first makes this immediate.

8. **8**

   $2^3 = 8$. Every input doubles the number of combinations.

9. **About twenty**

   Each comparison halves the remaining search range; about 20 comparisons suffice for a million ordered items. This excludes any cost of sorting beforehand.

10. **A cycle contains an edge you could remove and still reach everywhere**

    Removing any cycle edge preserves connectivity and lowers total cost because its weight is strictly positive. Thus a cyclic subgraph cannot be minimum under these assumptions.

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