Q1. 
\(a.\) As there are 10 dimensions, and there is no dimension with concept hierarchy, there are \((1 + 1)^{10} = 1024\) cuboids in the data cube.

\(b.\) 2813. Hint: First, we consider those cuboids with at least one of the first 3 dimensions not aggregated (i.e. not \(\ast\)), for example cuboid \((d1, \ast, \ast, \ast)\). For each base cell, the number of such cuboids is \((2^3 - 1) \times 2^7 = 896\). Since we have 3 such base cells, the total number of cuboids in this case is \(3 \times 896 = 2688\). However, since we are considering aggregated cells, we need to minus 3 base cells. Second, we consider those cuboids with the first three dimensions aggregated, for example cuboid \((\ast, \ast, \ast, d4, \ldots, d10)\), the number of such cuboids is \(2^7 = 128\). Since all 3 base cells are same if we only consider the last 7 dimensions, the total number of cuboids in this case is 128. Finally, the total number of non-based cells is \(2688 - 3 + 128 = 2813\).

\(c.\) 128. Hint: Only those cells with the first 3 dimensions aggregated (i.e. \(\ast\)), for example the cell \((\ast, \ast, \ast, d4, d5, \ldots)\), have count 3. The number of such cells is \(2^7 = 128\).

\(d.\) 7. Hint: There is only one closed cell with count 3, i.e. \((\ast, \ast, \ast, c4, c5, c6, c7, c8, c9, c10)\). So the number of non-star dimensions is 7.

Q2. 
\(a.\) 24. Hint: (2+1)*(1+1)*(1+1)*(1+1).

\(b.\) 48. Hint: As long as you understand the concept of cuboid and cell, you can find the answers with minimum effort for question b-f.

\(c.\) 34.

\(d.\) 23.

\(e.\) 2.

\(f.\) 2.

Q3. 
\(a.\) 1. 30. Hint: As long as you understand a particular frequent pattern mining technique, you can find the answers to all questions with a simple code. Frequent patterns are those with occurrences greater than or equal to minimal support.

2. 8. Hint: Length 3 means there are exactly 3 items in the pattern. For example, pattern \(\{A, B, C\}\) is of length 3.

3. 7. Hint: Note that max pattern is neither maximum length nor maximum support. Based on the definition, a pattern \(X\) is a max pattern if (1) \(X\) is frequent, and (2) there exists no frequent super-pattern \(Y\) containing \(X\).

\(b.\) 1. 55. Hint: For problems 1-3, please refer to (a).

2. 20.

3. 6.

4. 0.679. Hint: The confidence of \((C, E) \rightarrow A\) is the support of \(ACE\) divided by the support of \(CE\).

5. 0.742. Hint: Similar to 4.