1. Suppose we have a series of matrices $A_1, A_2, \ldots, A_n$ and each matrix $A_i, i \in \{1 \ldots n\}$ has dimension $p_{i-1} \times p_i$, fully parenthesize the product $A_1A_2 \ldots A_n$ in a way that minimizes the number of scalar multiplications.

The matrix multiplication is done using the following algorithm:

**Algorithm Matrix-Multiply(A,B)**

**Input:** Two Matrix $A, B$

**Output:** $AB$

1. if $\text{columns}[A] \neq \text{rows}[B]$
2. then error "incomplete dimensions"
3. else for $i \leftarrow 1$ to $\text{rows}[A]$
4. do for $j \leftarrow 1$ to $\text{columns}[B]$
5. do $C[i, j] \leftarrow 0$
6. for $k \leftarrow 1$ to $\text{columns}[A]$
7. do $C[i, j] \leftarrow C[i, j] + A[i, k].B[k, j]$
8. return $C$

**Solution:** The problem is discussed in Section 15.2 of book "Introduction to Algorithms."

2. Suppose we have a set $S = \{a_1, a_2, \ldots a_n\}$ of $n$ proposed activities that wish to use a resource, such as a lecture hall, which can be used by only one activity at a time. Each activity $a_i$ has a start time $s_i$ and a finish time $f_i$, where $0 \leq s_i < f_i < \infty$. If selected, activity $a_i$ takes place during the half-open time interval $[s_i, f_i)$. Activities $a_i$ and $a_j$ are compatible if the intervals $[s_i, f_i)$ and $[s_j, f_j)$ do not overlap. Select the maximum-size subset of mutually compatible activities.

**Solution:** The problem is discussed in Section 16.1 of book "Introduction to Algorithms."