**CMP 418 Assignment 1**

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**ASSIGNMENT**

**List of the Problems**

**Searching**

**Sorting**

**String Matching**

**Image Processing (real or generated)**

**Graphical Problems**

**Numeric Problems**

**Voice Matching**

**Geometric Problems**

**Combinatorial Problems**

All the problems listed are considered computing problems because they involve taking some input data, manipulating it according to specific rules, and producing an output that solves or analyzes the data. Below is a breakdown of the specific reasons for each category and some examples of the design algorithms used:

**1. Searching:**

**Reason:** In computing, searching involves locating specific items within a collection. It's a core problem due to its frequent occurrence in various applications.

**Algorithms:** Linear Search, Binary Search, Hash Tables, Jump Search

**2. Sorting:**

**Reason:** Arranging data in a specific order (numerical or alphabetical).

**Algorithms:** Bubble Sort, Insertion Sort, Selection Sort, Merge Sort, Quick Sort, Heap Sort

**3. String Matching:**

**Reason:** String matching involves identifying patterns within text data, crucial for tasks like text search and DNA analysis.

**Algorithms:** Knuth-Morris-Pratt (KMP), Boyer-Moore, Rabin-Karp

**4. Image Processing (Real and Generated Images):**

**Reason:** Image processing manipulates digital images for various purposes like enhancement and analysis, widely used in fields like medicine and facial recognition.

**Algorithms:** Edge Detection, Image Filtering (e.g., blurring, sharpening), Feature Extraction (e.g., identifying shapes, objects), Image Compression (e.g., JPEG)

**5. Graphical Problems:**

**Reason:** Graphical problems encompass challenges in computer graphics such as rendering and animation.

**Algorithms:** Shortest Path (finding the quickest route between two points in a network), Minimum Spanning Tree (creating a network connecting all nodes with minimal cost), Depth-First Search, Breadth-First Search

**6. Numeric Problems:**

**Reason:** Performing calculations and solving problems involving numerical data.

**Algorithms:** varies based on the particular task, e.g., Matrix Multiplication, Fast Fourier Transform (efficient signal processing), Numerical Integration (approximating integrals), Differential Equation Solvers

**7. Voice Matching:**

**Reason:** Voice matching compares and recognizes patterns in voice data, used in speech recognition and speaker identification.

**Algorithms:** Dynamic Time Warping (comparing the patterns of speech), Mel-Frequency Cepstral Coefficients (MFCC - extracting features from speech), Hidden Markov Models (statistical models for speech recognition)

**8. Geometric Problems:**

**Reason:** Geometric problems involve computations and manipulations of geometric objects, common in fields like computer graphics and robotics.

**Algorithms:** Convex Hull (finding the smallest enclosing shape for a set of points), Closest Pair (finding the two closest points in a set), Polygon Triangulation (dividing a polygon into triangles)

1. **Combinatorial Problems:**

**Reason:** Counting, arranging, or selecting objects according to specific rules. These problems often involve finding the most efficient or optimal way to do so.

**Algorithms**: Dynamic Programming (Breaking down problems into smaller sub-problems and efficiently solving them to find the optimal solution.) Branch and Bound (Systematically exploring possible solutions and discarding unlikely ones to find the optimal solution faster) Backtracking (Exploring all possible configurations or arrangements of objects to find valid solutions), Inclusion-Exclusion Principle (Used for counting objects that may belong to multiple categories, correcting for over-counting).