**Informed Search Algorithms – Research-Based Tasks**

**🔰 Level 1: Understanding Core Concepts**

**Task 1: What is a Heuristic?**

**Objective:**  
Research and define the term *heuristic* in the context of AI and search algorithms.

* What does a heuristic function do?
* How does it differ from path cost?
* Why is it used in informed search?

**Deliverable:**  
A one-page written explanation with real-world examples.

**Task 2: Admissible vs Inadmissible Heuristics**

**Objective:**

* Research what it means for a heuristic to be admissible.
* Find at least **two examples** of admissible heuristics and **one inadmissible** heuristic.
* Explain the consequences of using an inadmissible heuristic in A\*.

**Deliverable:**  
Table comparing admissible/inadmissible heuristics with examples.

**Task 3: Consistent (Monotonic) Heuristic**

**Objective:**

* Define a consistent heuristic.
* What is the mathematical condition for consistency?
* Find a situation where a heuristic is admissible but not consistent.

**Deliverable:**  
Summary of findings + example scenario.

**Task 4: Differences Between Tree Search and Graph Search**

**Objective:**

* Research the difference between **tree search** and **graph search** in the context of search algorithms.
* What are the advantages and limitations of each?
* When would each be preferred?

**Deliverable:**  
Comparison table + written explanation.

**🧭 Level 2: Exploring Specific Algorithms**

**Task 5: Greedy Best-First Search (GBFS)**

**Objective:**

* Research how GBFS works.
* How does it select the next node to expand?
* What are its strengths and weaknesses?

**Deliverable:**  
Summary report + diagram of node selection.

***Task 6: A Search Algorithm*\***

**Objective:**

* Explain how A\* combines g(n) and h(n) to compute f(n).
* What is the role of each component?
* In what scenarios is A\* considered optimal?

**Deliverable:**  
Written explanation + one example problem (e.g., path in a map) with annotated steps (no coding).

***Task 7: Why A is Optimal (with Admissible Heuristic)*\***

**Objective:**

* Explore the reasoning or proof sketch of why A\* is guaranteed to find an optimal path if h(n) is admissible.
* Why is consistency even better?

**Deliverable:**  
Write-up in bullet points + cited source.

**Task 8: Comparison Table – BFS, DFS, GBFS, A\***

**Objective:**  
Create a table comparing the following algorithms:

* Breadth-First Search
* Depth-First Search
* Greedy Best-First Search
* A\* Search

**Compare on:**

* Use of heuristic
* Completeness
* Optimality
* Time complexity
* Space complexity

**Deliverable:**  
Clean comparison table.

**🌍 Level 3: Real-World and Heuristic Design**

**Task 9: Heuristics in Real Life**

**Objective:**  
Find examples of heuristics used in **real-world applications**:

* GPS navigation
* Game AI (e.g., Chess, Pacman)
* Robotics

**Deliverable:**  
One-slide explanation for each real-world example (include images if possible).

**Task 10: Designing a Heuristic Function (Conceptual)**

**Objective:**  
Choose one of the following:

* Maze solving
* Food delivery path planning
* Robot vacuum cleaning

Design a heuristic *conceptually*:

* What would you estimate as the remaining cost to goal?
* What factors would your heuristic consider?