**Data Structures Fundamentals Exam – C#**

This document defines the exam preparation for <insert judge link here>**.**

Please submit your solutions (**source code**) of all below described problems in <insert judge link here>.

# Delivery System – 100 pts

You’ve been tasked with implementing a program for managing a delivery system. The software should work with deliverers, which deliver packages.

You are given a skeleton with a class **DeliveriesManager** that implements the I**DeliveriesManager interface.**

This **Delivery System** works with **Deliverers** and **Packages** asentities. All entities are identified by a **unique Id**.

The **Deliverer** entity contains the following properties:

* **Id** – string
* **Name** – string

The **Package** entity contains the following properties:

* **Id** – string
* **Receiver** – string
* **Address** – string
* **Phone** – string
* **Weight** – double

Implement the following functionalities to make the **Delivery System** software fully operative:

* **void AddDeliverer(Deliverer deliverer)** – **adds** an **deliverer** to the **Delivery System** software.
* **void AddPackage(Package package)** – **adds** a **package** to the **Delivery System** software.
* **bool Contains(Deliverer deliverer)** –returns whether the **deliverer** is **contained** inside the **Delivery System** software.
* **bool Contains(Package package)** –returns whether the **package** is **contained** inside the **Delivery System** software.
* **IEnumerable<Deliverer> GetDeliverers() –** returns a collection of all **deliverers**.
* **IEnumerable<Package> GetPackages() –** returns a collection of all **packages**.
* **void AssignPackage(Deliverer deliverer, Package package) –** assigns the given **package** to the given **deliverer**. If the **deliverer** or the **package** do **not** **exist** in the Delivery System - **throw ArgumentException()**
* **IEnumerable<Package> GetUnassignedPackages() –** returns a collection of all **packages**, which have not been assigned to any **deliverer**.
* **IEnumerable<Package> GetPackagesOrderedByWeightThenByReceiver ()** – returns all of the **packages** ordered by **weight** in **descending order**, then by **receiver** in **alphabetical (ascending)** **order**.   
  If there aren’t any packages – return an **empty collection**.
* **IEnumerable<Deliverer> GetDeliverersOrderedByCountOfPackagesThenByName()** – returns all of the **deliverers** ordered by **count of packages** in **descending order**, then by **name** in **alphabetical (ascending)** **order**.   
  If there aren’t any deliverers – return an **empty collection**.

**NOTE: If all sorting criteria fails, you should order by order of input. This is for all methods with ordered output.**

* 1. **Delivery System – Performance – 50 pts**

For this task you will only be required to submit the **code from the previous problem**. If you are having a problem with this task you should **perform detailed algorithmic complexity analysis** and try to **figure** **out** **weak** spots inside your implementation.

For this problem it is important that other operations are **implemented** **correctly** according to the specific problems: **add**, **size**, **remove**, **get** etc… Also, make sure you are using the correct data structures. ☺

You can submit code to this problem **without full coverage** from the previous problem, **not all test cases** will be considered, only the **general** **behaviour** will be important, **edge** **cases** will mostly be ignored such as throwing exceptions etc…

# Airlines – 100 pts

You’ve been tasked with implementing a program for managing an airline tracking system. The software should work with airlines and flights.

You are given a skeleton with a class **AirlinesManager** that implements the **IAirlinesManager interface.**

This **Airlines System** works with **Airlines** and **Flights** asentities. All entities are identified by a **unique Id**.

The **Airline** entity contains the following properties:

* **Id** – string
* **Name** – string
* **Rating** - double

The **Flight** entity contains the following properties:

* **Id** – string
* **Number** – string
* **Origin** – string
* **Destination** – string
* **IsCompleted** – boolean

Implement the following functionalities to make the **Airlines System** software fully operative:

* **void AddAirline(Airline airline)** – **adds** an **airline** to the **Airlines System** software.
* **void AddFlight(Airline airline, Flight flight)** – **adds** a **flight** to the given **airline** in the **Airlines System** software. If the airline does not exist - **throw ArgumentException()**
* **bool Contains(Airline airline)** –returns whether the **airline** is **contained** inside the **Airlines System** software.
* **bool Contains(Flight flight)** –returns whether the **flight** is **contained** inside the **Airlines System** software.
* **void DeleteAirline(Airline airline)** – **removes** the given **airline** from the **Airlines System** software and every Flight associated with it. If the airline does not exist - **throw ArgumentException()**
* **IEnumerable<Flight> GetAllFlights() –** returns a collection of all **flights**.
* **Flight PerformFlight(Airline airline, Flight flight) –** performs the **given flight** **– setting** its **IsCompleted** property to **true**, and **returning** it as a **result**. If the **airline** or the **flight** do **not** **exist** in the Airline System - **throw ArgumentException()**
* **IEnumerable<Flight> GetCompletedFlights() –** returns a collection of all **completed flights**.
* **IEnumerable<Flight> GetFlightsOrderedByCompletionThenByNumber()** – returns all of the **flights** ordered by **number** in **asceding (alphabetical) order** – flights that are not completed (**IsCompleted** is **false**) should be **returned first**.   
  If there aren’t any flights – return an **empty collection**.
* **IEnumerable<Airline> GetAirlinesOrderedByRatingThenByCountOfFlightsThenByName()** – returns all of the **airlines** ordered by **rating** in **descending order**, then by **count** of **flights** in **descending** **order**, then by **name** in **ascending** (**alphabetical**) order.   
  If there aren’t any airlines – return an **empty collection**.
* **IEnumerable<Airline> GetAirlinesWithFlightsFromOriginToDestination(string origin, string destination)** – returns all of the **airlines** which contain **atleast 1 flight**, which is not completed (**IsCompleted** is **false**) and has **origin** **equal** to the **given one** and **destination** **equal** to the **given one**.  
  If there aren’t any eligible results – return an **empty collection**.
  1. **Airlines – Performance – 50 pts**

For this task you will only be required to submit the **code from the previous problem**. If you are having a problem with this task you should **perform detailed algorithmic complexity analysis** and try to **figure** **out** **weak** spots inside your implementation.

For this problem it is important that other operations are **implemented** **correctly** according to the specific problems: **add**, **size**, **remove**, **get** etc… Also, make sure you are using the correct data structures. ☺

You can submit code to this problem **without full coverage** from the previous problem, **not all test cases** will be considered, only the **general** **behaviour** will be important, **edge** **cases** will mostly be ignored such as throwing exceptions etc…