Software Analysis and Design Project
Final Exam (May 2017)

Shark-Adventure, is a company that organizes diving excursions (or tours), and you are in charge of developing its new application for managing online services with the requirements described below.

The application has three main types of users. First, the *manager* is responsible for the creation, modification, and deletion of both material resources and personnel that the company employs (as we will describe next). He/she will also be responsible for managing the initial design of diving excursions, assigning to them the corresponding resources and other information. Second, the company's *diving instructors* will plan the detail of each excursion created by the manager. Eventually, the manager may also plan the details of any excursion if necessary. Finally, the application must also deal with *scuba divers*[1], who want to dive in the excursions offered by the company. Each diver needs to be properly authenticated in order to be able to interact with the system online. Without being authenticated, a scuba diver user may consult general information about excursions, but cannot enrol in any of them until he/she is not registered in the application. To register, the scuba divers indicate their e-mail, maximum diving qualification (expressed by a positive integer between 1 (the lowest qualification) and 10), total diving hours accumulated so far and the expiration date of their accident insurance.

The company employs a number of qualified diving instructors, which are registered in the application by the manager, using their official diving license number as identifier. The company also owns several dive boats to perform the excursions. Each one of these boats has its own features, like the maximum number of passengers, horse power of the engine, and date of the next mandatory inspection.

An excursion consists in diving through a zone with underwater interest. An excursion is made of a combination of diving sites, or other interest zones previously described. A diving site can be included in several zones, and a zone can be contained in several other zones or in several excursions. The manager is in charge of administering both the diving sites and the zones of interest. The diving sites are described by a name, a diving depth limit, and their positioning coordinates (latitude and longitude). The interest zones are described by a name and other zones that they may contain.

The manager designs every excursion in advance, assigning a price, a date, a boat, a boat captain (one of the instructors), the maximum number of scuba divers, a minimum qualification required, and a leader instructor in charge of the excursion. Once this information is input, the excursion becomes *pending*, until the leader instructor (or the manager) completes the excursion configuration with a description of the divings to perform, the number of total diving hours, and the total time of decompression stops required when reaching the water surface. When this information is input, the excursion is *published* in the application, so that scuba divers can enrol.

Before accepting any enrolment in any excursion, the system should verify that the excursion has vacancies, that the user has the minimum required qualification, and that his insurance date is valid. If these conditions are met, the application offers on-line payment (through an external electronic payment system) of the total excursion price. Once the payment is confirmed, the user becomes enrolled in the excursion. When the number of divers enrolled reaches half of the available places, the excursion becomes *confirmed* (at this point it cannot be cancelled, but can still receive new enrolments). When the number of enrolled divers reaches the maximum number of places, the excursion becomes *closed* and cannot admit more enrolments. At any moment, the manager may cancel any excursion that has not been confirmed, which implies the payment refund for the enrolled divers. Similarly, the system will automatically cancel the excursions that are not confirmed one week before their starting date. The closed excursions will remain visible on-line for historical reasons. However, the cancelled excursions will not remain stored within the application. When an excursion is *performed*, the number of diving hours of each participant will get updated.

Questions are not allowed during the exam

Please, limit your answers to the strict content of the exam text. You may need to make assumptions over details not covered by the exam text. You are allowed to do so, but always in a grounded, reasonable way, which should not contradict the exam text. Please carefully document such assumptions in your answers.

ANSWER EACH QUESTION IN A SEPARATE SHEET

[1] *Scuba diver*: submarinista

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In all sections, you must use the UML notation, so that your answers become formalized in a standard way, like all analysis and design models in a real project should be. Expressing your ideas, even if correct, in a language different from UML is not acceptable in this exam.

Section 1. (2 points)
Draw the use case diagram of the application.

Section 2. (4 points)
Draw the complete class diagram of the application. Do not forget to include all necessary attributes and methods to implement the functionality described in the exam text. You do not need to include constructors, getters or setters, but please give full details of method signatures (method name, parameters with their type and return type).

Section 3. (2 points)
Draw the state transition diagram that describes the behaviour of class *Excursion*.

Section 4. (2 points)
Draw the sequence diagram reflecting the process *enrolment in an excursion*, including the verification of required conditions.

ANSWER EACH QUESTION IN A SEPARATE SHEET