# Module Handbook Maritime Information Systems

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| Scheme & Programme | M.Sc. Shipping Management | | |
| Module Title | Maritime Information Systems | | |
| Module Code | | | |
| Module Start Date/ Cohort | 2018-19 | | |
| Module Level | Level 7 | Credit Rating | [5 ECTS credits] |
| Total study time | 10 hours academic directed time<br>3,5 hour lecture per week | Hours of independent Learning and time for assessments | 125 hours of teaching and independent learning and time for assessments |
| Module Leader& Lecturer: | Assistant Prof. Alexander Artikis | | |
| Email: | a.artikis@unipi.gr | | |
| Room: | | | |
| Office Hours: | Please email me for any queries or see me in sessions. | | |
| Seminar Tutor(s): | | | |
| Programme Director: | Dr. Angelos Pantouvakis | | |
| Administrator contact: | Mrs. Tzeni Prokopiou, 2104142542 | | |
| Administrator e- mail: | nafadmin@unipi.gr | | |
| Lecture day & time: | Fridays   17.30-21.00 | | |
| Seminar day & time: | | | |

## 1. Welcome Note

Welcome to the Maritime Information Systems course of M.Sc. Shipping Management Program, University of Piraeus. This module helps students learn and understand the fascinating world of information systems, as applied to the maritime domain.

## 2. Module aims

- ▪ To introduce the state-of-the-art maritime monitoring systems.
- ▪ To present the keys concepts of database systems.
- ▪ To equip students with skills and tools for maritime data analytics.

## 3. Learning Outcomes–what you will gain from taking the module:

By the end of this module, students should be able to:

- Evaluate a system for maritime monitoring
- Evaluate a maritime data processing system
- Develop database queries for maritime data analytics.

## 4. Indicative Module Content:

This module will present the main state-of-the-art maritime monitoring systems, such as the widely adopted Automatic Identification System (AIS), which is the basic building block of modern vessel tracking platforms. Furthermore, the module will introduce the field of database systems, in order to equip the students with the skills of maritime data analytics.

## 5. How the module is taught, attendance and the teaching schedule:

The module will utilize flexible, responsive and interactive learning environments using a combination among lectures, seminars, workshops and independent self-assessment tasks, to encourage students' ability to think critically and creatively. Moreover, state-of-the-art database management systems will be demonstrated, thus allowing students to become familiar with practical software solutions of maritime data analysis.

### a. Teaching Schedule per every one of the 9 weeks

| Lecture Date | Topic |
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| Week 1 | **MARITIME MONITORING SYSTEMS**<br><br>• Passive systems (satellite systems)<br>• Active systems (COSPAS-SARSAT, NAVTEXT, AIS, LRIT, etc)<br>• Hybrid systems<br><br>**Reading Material:**<br>• https://bluehub.jrc.ec.europa.eu/research_areas_maritime/<br>• Zampieri A., Vespe M., Westra M., Tarchi D., 'The full potential of AIS', Qatar Maritime Security - Coastal and Border Surveillance Conference (QMARSEC), Doha Qatar, 2015.<br>• Sammartino P. F., Vespe M., Tarchi D., Oliveri F, Papi F., Borghese F., Aulicino G., Vollero A., 'AIS Signal Radiolocation, Tracking and Verification', in Clean Mobility and Intelligent Transport Systems, IET publishing, ISBN: 978-1-84919-895-0. |

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| | • Natale, F., Gibin, M., Alessandrini, A., Vespe, M., Paulrud, A., 'Mapping Fishing Effort through AIS Data'. PLoS ONE 10(6): e0130746. doi:10.1371/journal.pone.0130746. 2015.<br>• Mazzarella F., Vespe M., Damalas D., Osio G.: 'Discovering Vessel Activities at Sea using AIS Data: Mapping of Fishing Footprints', Proc. 17th Int. Conf. on Information Fusion, 2014. |
| **Week 2** | **MARITIME DATA ANALYSIS**<br><br>• Maritime pattern detection<br>• Maritime Data Visualisation<br>• Origin-Destination Matrices<br>• Complex event recognition<br><br>**Reading Material:**<br>• Silberschatz, Korth, and Sudarshan (2010, 6th e): Database Systems Concepts, McGraw-Hill.<br>• Molina, Ulman and Widom (2001, 3rd e): Database Systems: The Complete Book, Prentice Hall.<br>• Patroumpas K., Alevizos E., Artikis A., Vodas M., Pelekis N., Theodoridis Y.: Online event recognition from moving vessel trajectories. GeoInformatica 21(2): 389-427 (2017)<br>• Pitsikalis M., Artikis A., Dreo R., Ray C., Camossi E., and Jousselme A. Composite Event Recognition for Maritime Monitoring. International Conference on Distributed and Event-Based Systems (DEBS), 2019. |
| **Week 3** | **INTRODUCTION TO RELATIONAL ALGREBRA**<br><br>• Relational schemas<br>• Super Key, Candidate Key, Primary Key, Foreign Key<br>• Integrity Constraints<br><br>**Reading Material:**<br>• Silberschatz, Korth, and Sudarshan (2010, 6th e): Database Systems Concepts, McGraw-Hill.<br>• Molina, Ulman and Widom (2001, 3rd e): Database Systems: The Complete Book, Prentice Hall. |
| **Week 4** | **RELATIONAL ALGREBRA: MARITIME DATABASE QUERYING**<br><br>• Selection, projection, renaming, union, set difference<br>• Cartesian product, inner join, outer join<br>• Maritime database querying<br><br>**Reading Material:**<br>• Silberschatz, Korth, and Sudarshan (2010, 6th e): Database Systems Concepts, McGraw-Hill.<br>• Molina, Ulman and Widom (2001, 3rd e): Database Systems: The Complete Book, Prentice Hall. |

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| **Week 5** | **RELATIONAL ALGREBRA: MARITIME DATABASE MODIFICATION**<br><br>•   Tuple insertion, Tuple deletion, Tuple modification<br>•   Maritime database modification<br>•   Consequences of (maritime) database modification<br><br>**Reading Material:**<br>•   Silberschatz, Korth, and Sudarshan (2010, 6th e): Database Systems Concepts, McGraw-Hill.<br>•   Molina, Ulman and Widom (2001, 3rd e): Database Systems: The Complete Book, Prentice Hall. |
| **Week 6** | **INTRODUCTION TO SQL**<br><br>•   Basic query structure<br>•   Set operations<br>•   Null values<br><br><br>**Reading Material:**<br>•   Silberschatz, Korth, and Sudarshan (2010, 6th e): Database Systems Concepts, McGraw-Hill.<br>•   Molina, Ulman and Widom (2001, 3rd e): Database Systems: The Complete Book, Prentice Hall. |

| Week 7 | SQL: AGGREGATION AND COMPLEX QUERY EXECUTION <br><br> • Aggregate functions <br> • Query execution order <br> • Nested subqueries <br><br> **Reading Material:** <br> • Silberschatz, Korth, and Sudarshan (2010, 6th e): Database Systems Concepts, McGraw-Hill. <br> • Molina, Ulman and Widom (2001, 3rd e): Database Systems: The Complete Book, Prentice Hall. |
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| Week 8 | DATABASE MANAGEMENT SYSTEMS AND VISUAL ANALYTICS SYSTEMS <br><br> • PostgreSQL <br> • QGIS <br> • Maritime information extraction and visualisation <br><br> **Reading Material:** <br> • Silberschatz, Korth, and Sudarshan (2010, 6th e): Database Systems Concepts, McGraw-Hill. <br> • https://www.postgresql.org/ |
| Week 9 | SQL: JOIN AND MARITIME DATABASE MODIFICATION <br><br> • Join of relations <br> • Database Modification <br> • Maritime database querying and modification: demonstration <br><br> **Reading Material:** <br> • Silberschatz, Korth, and Sudarshan (2010, 6th e): Database Systems Concepts, McGraw-Hill. <br> • Molina, Ulman and Widom (2001, 3rd e): Database Systems: The Complete Book, Prentice Hall. |

**6. Assessment**

The module will be assessed on the basis of two components:

A) Individual performance (20%): class participation, assignments, cases, exercises, tests

B) Written exams (80%): A 2-hour written exam test.

| Assessment Title and Brief Description | Word count/ Hrs where applicable | Weight | Submission deadline | Submission method | Feedback date | How feedback is provided |
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| Individual performance (class participation, assignments, cases, exercises, tests) | - | 20% | Continuous | In class | TBD | - |
| Written exams | 2hrs | 80% | TBD | In class | TBD | - |

Any changes to the assessment schedule will be communicated by e-mail and/ or announcement on the module's E-College pages.

### 7. Recommended Reading

1. **Main Textbook for the Course:**

• Silberschatz, Korth, and Sudarshan (2010, 6th e): Database Systems Concepts, McGraw-Hill.

2. **Support Textbook:**

▪ Molina, Ulman and Widom (2001, 3rd e): Database Systems: The Complete Book, Prentice Hall.

**Additional Course Material:**

- Lectures Outline

- Course Slides

- Maritime data (AIS position signals)

- Selected Problems Review

- Academic Papers