

Test#1
2º Semester, 2011/2012

CLOSED BOOK. Duration: **2 hours**

NAME: _____ **NUMBER:** _____

IMPORTANT: Read the text carefully before answering. **Succinct answers are prized.**

PART A

Question 1 – Regarding pervasive/ubiquitous and mobile computing computing as computer systems disciplines...

- a) **Define** pervasive/ubiquitous computing?
- b) **Discuss** the relationship between pervasive/ubiquitous computing and mobile computing.
- c) **What** are the new challenges of mobile computing compared to those of distributed systems in general? **Explain.**
- d) Some of the “classic” challenges in distributed systems become harder in the face of mobility... **Provide** two best examples (of challenges) of that. **Justify.**

Question 2 – Regarding wireless networking...

- a) What are the key characteristics of wireless communication links that differentiate them **most** from wired links?
- b) Explain the difference between infrastructure-oriented and ad-hoc approaches to wireless networking? **Discuss** their relative strengths and weaknesses; **provide** a best-case scenario for ad-hoc wireless communication.
- c) Bluetooth is a well-established wireless networking technology, readily available in consumer mobile devices. **What** is the main purpose of this technology?

Question 3 – Regarding wireless sensor networks (WSNs)...

- a) Classic routing algorithms tend to perform poorly when ported to WSNs. **Explain** why.
- b) What is source routing? And what are the main problems of this technique, in particular in the context of WSNs?
- c) Explain the general idea and architecture behind what is known as Mobile IP.

Question 4 – Regarding location systems...

- a) **Discuss** the main issues involved in converting between location and position (and vice-versa).
- b) Cricket and Active Bat are indoor systems for locating users. **Explain** why (and what for) both employ two different wireless communication technologies to achieve their purpose, **describing** the general idea behind one of these systems.
- c) Using GPS to obtain a device’s position can take a long time, especially the first time since power up. **Explain** possible causes for such delay.

PART B

Question 5 – Consider the following research paper abstract:

“Real-time Detection of Anomalous Taxi Trajectories from GPS Traces”

ABSTRACT: *“Trajectories obtained from GPS-enabled taxis grant us an opportunity to not only extract meaningful statistics, dynamics and behaviors about certain urban road users, but also to monitor adverse and/or malicious events. In this paper we focus on the problem of detecting anomalous routes by comparing against historically “normal” routes. We propose a real-time method, iBOAT, that is able to detect anomalous trajectories “on-the-fly”, as well as identify which parts of the trajectory are responsible for its anomalousness. We evaluate our method on a large dataset of taxi GPS logs and verify that it has excellent accuracy ($AUC \geq 0.99$) and overcomes many of the shortcomings of other state-of-the-art methods”*

credits: Chao Chen et al, In proc. Mobiquitous 2011

- a) **Discuss** an overall solution/architecture for implementing iBoat, **assuming** the developer is a large taxi provider company.
- b) An alternative approach, more along the lines of Participatory Sensing (P/S) principles, could be the taxi users themselves form a community-driven effort to provide and support the service...(possibly, without any involvement of the taxi providers)

Discuss the main challenges, from a pervasive/ubiquitous computing perspective, that would involve the development of such a system, around P/S principles.