UiO / IFI / PUT
Spring 2025
Questions on Location

1. In the context of location systems, consider those systems based on **signal strength fingerprinting**, and that WiFi is used for that purpose. i) State what it consists of (i.e. the location system based on **signal strength fingerprinting**). ii) Assuming that the system is able to locate people/objects within 2 meters in 90% of the cases, state its precision and accuracy. iii) Point out two disadvantages of this kind of location solution.

2. In the context of location, what is the meaning of wardriving?

3. Are light and sound the types of signals well suited for indoor location systems? Why?

4. Consider the GPS for locating some user. How is the uncertainty area affected (increases or decreases) if the distance between the satellites increases? Present a figure that illustrates your answer.

5. In the context of location systems, describe the notion of accuracy. Illustrate this notion with an example.

6. Consider the several techniques that can be used to provide location information. Provide a concrete example of a technology that can be used, classify it, and explain the notions of precision and accuracy.

7. Consider an indoor location system based on infrared. What is one of the main disadvantages of this solution?

8. Consider a **GPS** based location system. Such a system is made of three distinct components. Which components are these? What characteristics and function does each component have?

9. The GPS location system has some errors that are dealt with. What are these?

10. What does Differential GPS takes advantage of? And what is that done?

11. The **receiver's location** in three-dimensional space (x, y, z) and receiver **clock bias b** is determined by solving the following equation for at least four satellites (just three satellites would be required with perfect clocks):

$$R_i = \sqrt{(x_i - x^2) + (y_i - y)^2 + (z_i - z)^2} - b$$

Explain this formula.

12. Explain what is Real-time differential GPS (DGPS) and give some examples.

13. What is a possible advantage of having several location systems similar to GPS?

14. How do you compare the several GPS-based systems regarding accuracy, coverage, cost of the infra-structure, per-client cost, and privacy? Explain you answer.

15. Globally, what kind of solutions can be devised for in-door location systems using infrared and/or ultrasound systems? What accuracy can be achieved approximately?

16. Explain how Active Badge work and what is its fundamental problem.

17. Explain how Walrus/Cricket/ActiveBat work.

18. How do you compare the several in-door systems based on infrared and/or ultrasound regarding accuracy, coverage, cost of the infra-structure, per-client cost, and privacy? Explain you answer.

19. Broadly speaking, there are two big families of location solutions based on WiFi. What are these? Explain how each one works.

20. Explain how Radar/ActiveCampus/PlaceLab work.

21. Regarding location solutions based on WiFi what can you say about its privacy?

22. Please compare the several approaches based on WIFi location regarding accuracy, coverage, cost of the infra-structure, per-client cost, and privacy? Explain you answer.

23. What kind (big families) of location systems can be devised when these are based on cellular radio signals.

24. Mention some of the other location approaches and compare them regarding accuracy, coverage, cost of the infra-structure, per-client cost, and privacy? Explain you answer.

25. Regarding indoor location techniques (signal properties), there are several solutions based on the arrival of the signal that is propagated to the receiver. Which solutions are these and how is the distance calculated?

26. Regarding indoor location techniques, what are the indoor location technologies used?