Vrije Universiteit, Department of Computer Science

Examination paper for **Pervasive Computing (resit)**

10th of February 2015, 18:30-21:15 KC137

This is a closed book written exam.

No printed material or electronic devices are admitted for use during the exam.

The answers may be given in English or Dutch.

Both practical work and exam are compulsory and graded on an 1 to 10 scale.

The exam grade is calculated as (Q1+Q2+...+Q6+10)/10.

The final grade is calculated as 0.5*PRAC + 0.5*EXAM.

A pass is given only if both practical work and exam components are >= 5.5.

	Q1	Q2	Q3	Q4	Q5	Q6	ΣQi	Maximum credits= (ΣQi+10)/10
a)	3	5	4	4	6	6		
b)	3	3	5	3	6	4		
c)	3	3		4	6			
d)		2		3	6			
e)		2		4				
f)				5				
Total	9	15	9	23	24	10	90	10

Good luck!

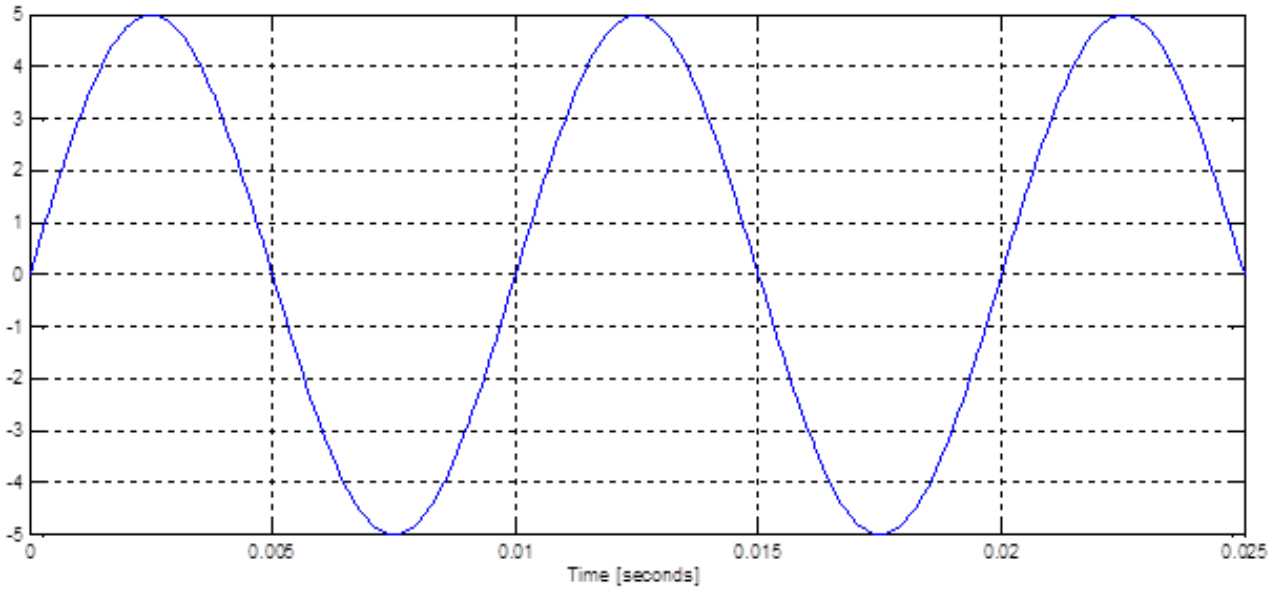
Q1. Systems [9p]

a) What are the three waves of computing according to Mark Weiser? [3p]
b) Explain what means implicit HCI. [3p]
c) What does MEMS mean? Give an example. [3p]

Q2. Signals [15p]

a) We have an 100x200 RGB image. The whole image is red. Describe its representation in the computer. What is its spatial resolution? What is its colour resolution? [5p]

Given the sinusoidal signal plotted below in time domain:



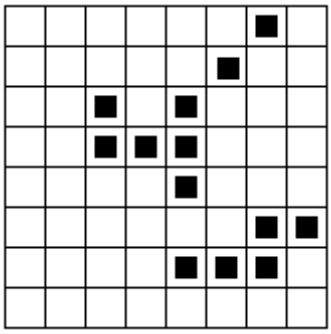
b) What is its amplitude? Its period? Its frequency ? [3p]
c) What would be a reasonable sampling frequency for this signal? Justify your answer. [3p]
d) How many samples we get if we sample the signal with the sampling frequency suggested in Q2c)? [2p]
e) What happens if we sample the signal with a frequency of 10Hz? [2p]

Q3. Control [9p]

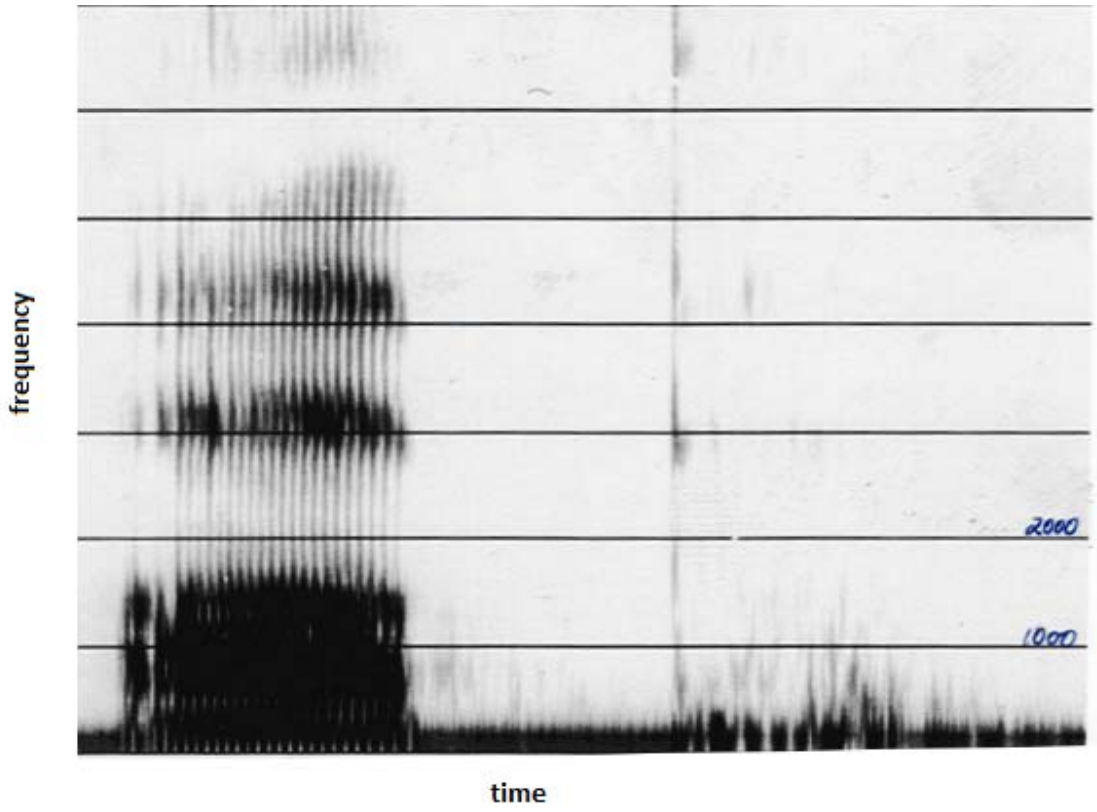
a) What does deliberative control mean? What is its principle? Where is it used? [4p]
b) Write in pseudocode a controller for a robot equipped with 2 optosensors, that follows a black line and stops at a T-junction. [5p]

Q4. Image & sound processing [23p]

a) Define histogram stretching. Where do we need it ? [4p]
b) What are morphological operations and why do we need them? [3p]
c) What does BLOB mean? How many BLOBs are in this image if we use 4-connectivity? [4p]

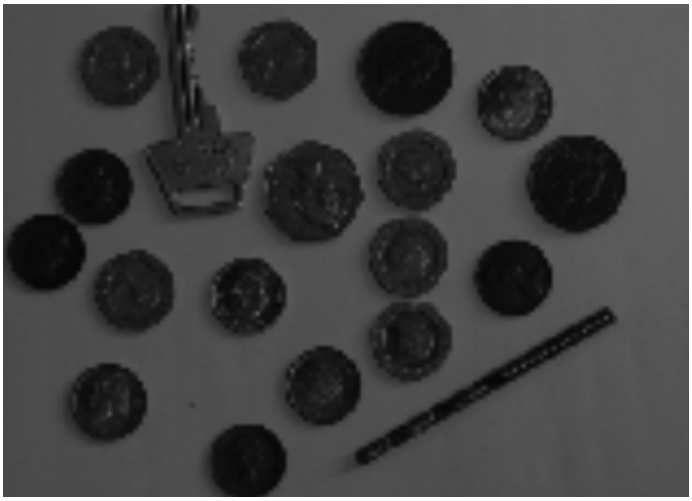


d) We take the signal from Q2b) and we add it to a signal with a frequency of 500Hz and a double amplitude. Sketch the resulted signal. [3p]
e) Sketch the frequency spectrum of this combined signal. [4p]
f) Which word is represented in the spectrogram below? “Fenomenon”, “Computer”, or “Up” ? Justify your answer. [5p]



5. Classification [24p]

a) Given the image below, explain how to solve the classification problem. [6p]



b) Explain what is an artificial neuron and how this neuron works. Can an artificial neuron classify? If yes how, if no why? Can an artificial neuron learn? If yes how, if no why? [6p]
c) Explain how Naïve Bayes classification works. [6p]
d) Enumerate and define the four metrics used in a classifier evaluation. What are the ideal values of these metrics in the case of a pedestrians recognition system? [6p]

6. Quality [10p]

a) We want to test a program for a human resources department, that decides how to process employment applications based on the person's age. The rules are:
    0-15 don't hire
    16-18 hire on part-time basis only
    19-65 hire full-time
    66-100 don't hire

Generate test cases for testing this module using equivalence partitioning. [6p]

b) Formulate an ethical question related to a self-driving car. [4p]