Institut für Betriebssysteme und Rechnerverbund
Abteilung Distributed and Ubiquitous Systems

Exercises for the lecture

Collaborative transmission in wireless sensor networks

Term: Winter 10/11 Stephan Sigg (sigg@ibr.cs.tu-bs.de) Exercise: 23.11.2010, 16:45 – 18:15

2 Communication in wireless networks and expected optimisation time

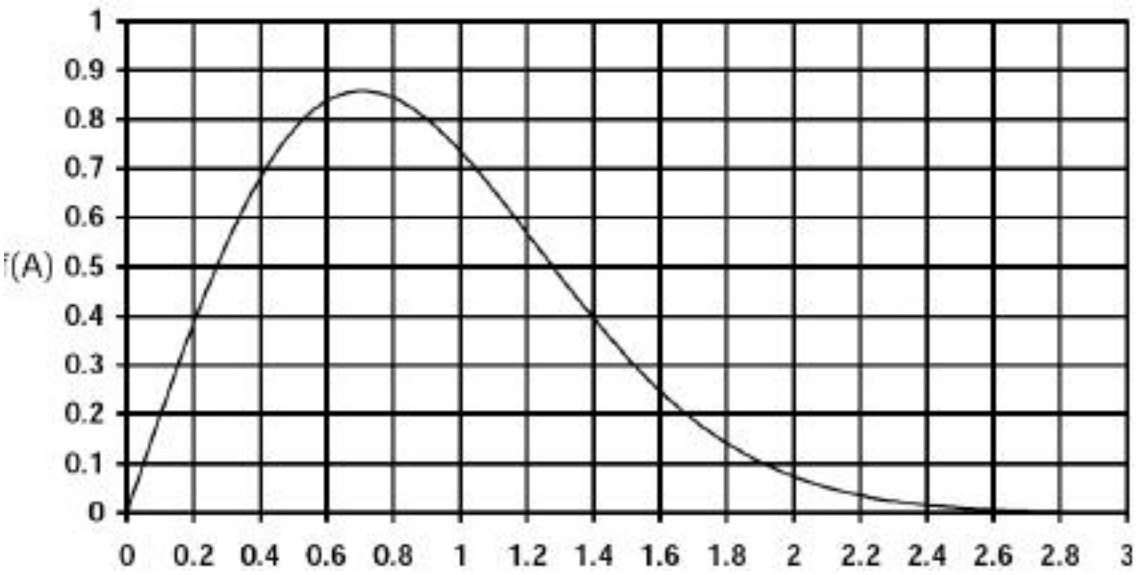
2.1 Doppler Shift

a) Assume a car heading directly towards a base station at a speed of 50 km/h. What is the amount of the Doppler frequency for a signal at 950 MHz?

b) Of what amount is the Doppler frequency if the car is circling around the base station at a speed of 70 km/h and with a radius of 20m?

2.2 Fading incursions

Consider a speech call in a GSM 900 network. Assume that the fading incursions due to multipath fading of the incoming signal are described by the probability density function depicted in the figure below. Furthermore, assume that the amplitude of the incoming signal is not allowed to



fall below 0.4 since an operation below this amplitude is not possible in the GSM system. In the figure, mark the region that describes the probability that the amplitude of the incoming signal falls below 0.4.

2.3 Expectation

Consider the experiment of throwing a dice with six sides and a coin that is labelled 1 and 2 on both sides.

a) When both are thrown together what is the expectation on the sum value of dice and coin?

b) Calculate with the Markov inequality the probability that the actual value deviates from the expectation by value 1

c) Calculate with the Chernoff inequality the probability that the actual value deviates from the expectation by value 1

2.4 Method of the fitness based partition

The artificial function ONEMAX is defined as

$$ONEMAX(x) = \sum_{i=1}^{n} x_i; x \in \mathbb{B}^n \tag{1}$$

Show that the expected optimisation time for an $(1+1)$-EA on ONEMAX is $\mathcal{O}(n \log n)$