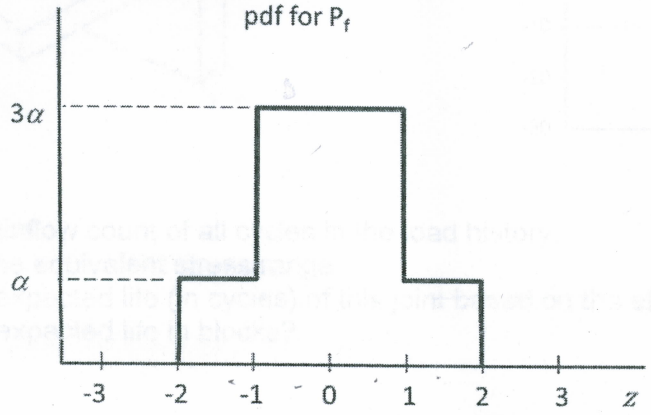
Aalto University
School of Science
and Technology

KUL-49.4350
Fatigue of Structures

Exam 13.12.2011

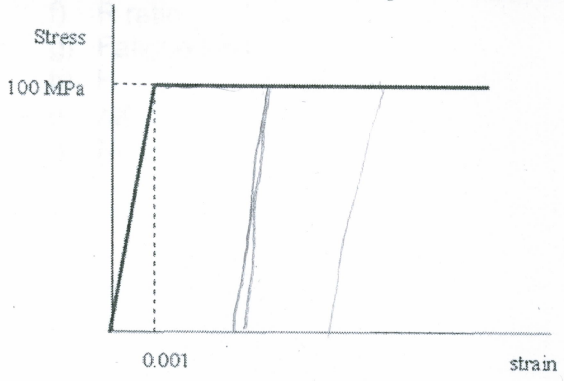
You should try each of the four problems. Each problem is of equal value. Answers may be written in English or Finnish. You may use a calculator. You may have one A4 size pages of notes visible. Other books or notes are not allowed.

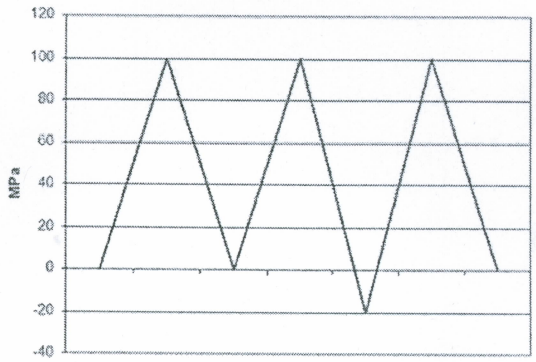
1. The probability density function shown below represents the failure probability, P_f, for a component. Find:
   a. the value α
   b. z for $P_f = 0.25$
   c. sketch the cumulative density function



Note: it is NOT needed to solve the problem, but the variable $z = \left(log(\overline{N_f}) - log(N_f)\right)/\sigma_N$ where $\overline{N_f}$ is the average fatigue life and σ_N is the standard deviation in (N_f).

2. An aluminium alloy has the monotonic stress strain curve shown. Assume that the material is cyclically stable and that the cyclic stress strain curve is the same as the monotonic curve.





A component constructed from this material is loaded with the above nominal stress sequence. Assume $K_t = 1.5$.

a) sketch σ–ε for the stress sequence.
b) provide a rainflow count of ε