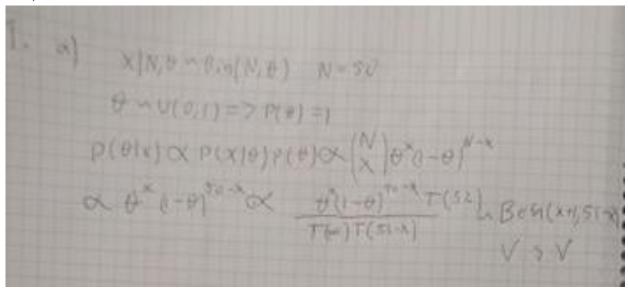
## Paper solutions

Exam TDDE07 2020 06/04

1 a)



2 d) Method T: Novad approximation
Method 7: Normal approximation  One can approximate the posteror  distrusive N(θ, J'(θ)) where  θ: Posterior mode and J = negative (g) d <sup>2</sup> log(p(θ x))(β)  (seend derivate of log posterior likelihood)  at θ = θ.  The posterior mode can be found by optimizing  max log(p(θ x ), using optim in R for  instance; Same with J.  Method 2! Hamiltonian monte carlog  which adds momentum to the sampling  distrustation, akin to a physics simulation,  using expressions for kinetic and potential  energy of the posterion.  7. Sample from momentum to begin  2. Simulate new theth proposal and momentum  (using leapthag algorithm)  3. compute acceptance probability  α = min(i, p(Σ θ)p(θ, j), p(Φp))
Of = min(1, $P(y \theta_p)p(\theta_p)$ $P(\phi_p)$ )  ( $\theta_p$ : theta proposar, $P(y \theta_p)p(\theta_p)$ )  4. With Probability an, set $\theta_p$ : momentum proposar) $\theta_p$ : $\theta_p$ : momentum proposar) $\theta_p$ : $\theta_$

4,6) At length = x n N(Vmc, 23) om = 2
P(NMLIX) & P(XINML) P(NML) &
7; Uniform prion
$\propto \exp\left(-\left(\frac{N_{\text{INC}}-\overline{X}}{2}\right)^{\frac{3}{2}}\right) \sim N\left(\frac{\overline{X}}{2}\right)^{\frac{3}{2}}$
/n=4/
PML = X + E // E ~ N(0, 22) =>
Yrred = NML + V // V n N(0, 22)
Ypred = X + E+V ~ N (X, 22(1+4))=
Ypred = N(12,5)
predictive variance = population variance + posterior variance