Here is what I jotted down while in the train headed home after the exam:

5 questions (so one less than in exam1), 8 points each (same amount as in exam1).
But all in all there were 15 sub-questions (so same amount as in exam1).
Again 15 min read-only time (no pen allowed), 90 min sharp for solving.

1. Distance proof
    a. 0 <= Dhell <= 1
    b. Dhell^2 <= ½ DKL almost like in sheet 2 ex4. Hint: $2(1-\sqrt{x})$ <= -log(x)?
2. Coupling, but different approach
    X,Y with 3 states {-1, 0, 1}, X is equally distributed, and probability of Y-states unevenly (0 -> ½, +/- 1 -> ¼)
    a. find bi-stochastic coupling matrix T0. X,Y independent
    b. X,Y dependent, minimise E((X-Y)^2), find Optimal transport coupling of bi-stochastic matrix T*
    W(T*) = E((X-Y)^2)
    c. show W(T0) > W(T*)
3. discrete time deterministic dynamical system
    a. show invariant, pi* given (exactly like sheet 7 ex1a))
    p^n+1 =(1/(4*($\sqrt{1-z}$))(p^n(f(z)+p^n(g(z))
    f(z) = ½+½$(1-z)$
    g(z)= ½-½$(1-z)$
    b. in Chapter 4-2 slide, page 29 (Example (Continuous ranked probability score)) . Given the graph of Scrps from 3 models, Which one is the worst model?
    c. Given 2 models, the first model is gaussian with N(0,1), and the second model is a gaussian mixture (2 gaussian, kind of "0.5xN(x;0.5,1.1) + 0.5*N(x;0.5,2.2)"), with given mean, variance and equal weight. With Yobs = 1. Determine using Slog scoring, which model will give better results.
4. Kalman Filter(Further development of Ex 9.2)
    a. show Pk_a <= R and Pk_a <= Pk_f. explain why this is desirable (for Pk_a <= R proving is in ex 9.2 b)
    b. k -> ∞ define the fixed point for Pk_a, show that it is the quadratic solution for Pk_a. check Ex9.2c
    c. We have 2 sensors. with variances R1>R2, show that K1 < K2 (Kalman gain) and give statements about your interpretation regarding that fact. Hint: K = Pa/R
5. ensemble Kalman with perturbed observations
    ξ~N(0,1), y = Hz +ξ
    $\widehat{Za}$ = Zk_f +Pk_f*H*(K)*(yobs-Hz)
    a. Find the distribution of $\widehat{Za}$ by determining the mean and covariance
    b. Define better za_mean using Kalman update formula to improve the posterior model
    c. Compare covariance a and b. Show that b is better model than a (wasn't there a "+ 1" somewhere in $\widehat{Za}$?)

All in all I found it very hard, nothing looked exactly like in the assignments, all texts did differ. 4 pages of text for the questions.