



KANDIDATNUMMER:

EKSAMEN

EMNENAVN: Matematikk for spillprogrammering

EMNENUMMER: REA2061

EKSAMENS DATO: 05.01.16

KLASSE: Bachelor Spillprogrammering

TID: 9-14

EMNEANSVARLIG: Bernt Tore Jensen (Kan kun nåes på telefon 46250024)

ANTALL SIDER UTLEVERT: 4 sider (inkludert denne)

TILLATTE HJELPEMIDLER: Godkjent kalkulator, Alle skrevne og trykte hjelpemidler

INNFØRING MED PENN.

Ved innlevering skilles hvit og gul besvarelse og legges i hvert sitt omslag.

Oppgavetekst, kladd og blå kopi beholder kandidaten.

Husk kandidatnummer på alle ark.

All relevant calculations and explanations must be included. Read the questions carefully. All problems contribute 25 per cent towards your final grade.

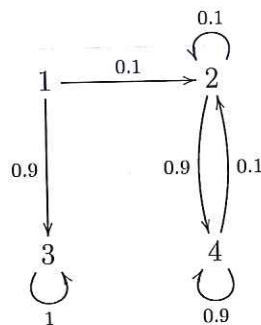
Problem 1.

Calculate probabilities when throwing 5 dice with 6 sides numbered 1 to 6.

- What is the probability that all 5 dice show 6?
- What is the probability that 2 dice show 1 and 3 dice show 6?
- What is the probability that exactly 3 dice show 6?
- What is the probability that at least one dice show 1 and at least three dice show 6?

Problem 2.

Given the following Markov chain



a)

Explain what is meant by an "ergodic Markov chain" and an "absorbing Markov chain". Is the Markov chain above absorbing? Is it ergodic?

b)

A simulation is run starting with state 1. What is the probability that the state is 3 after 1 iteration? What is the probability that the state is 3 after 100 iterations? (Hint: Look carefully at the picture above).

c)

Write down the matrix M of the Markov chain above.

d)

Write code (in any language) which uses the matrix M to calculate the probability of moving from state 1 to state 4 after 15 iterations. You can assume that matrix addition and multiplication has already been implemented using the operators $+$ and $*$ and that the matrix M is defined.

Problem 3.

In a knight, knave and spy puzzle the knight always tells the truth, the knave always lies and the spy sometimes lies and sometimes tells the truth. The puzzle consists of three statements, one from each character, and the task of the solver is to use these three statements to identify the three characters.

a)

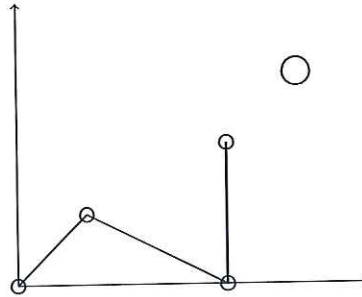
Create and write down a knight, knave and spy puzzle.

b)

Write down the solution to the puzzle in a).

Problem 4.

A robot arm is fixed with a joint at the origin and two additional joints located at $(1, 1)$ and $(3, 0)$. The effector is located at $(3, 2)$. The goal we want the effector to reach is located at $(4, 3)$.



a)

Calculate the lengths of the three arms and the angles at the three joints. The angle at the origin is calculated with respect to the x -axis.

b)

Compute the angles at the three joints after one iteration using cyclic coordinate descent (CCD). I.e. after all the angles have been adjusted exactly once.

c)

Does the effector reach the goal after one iteration? Explain what happens.