# Extra exercises Math3 week3

Linear algebra: topics: dot product, cross product

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EXERCISE 2 *(2+5+5 points)*

Given are the vectors a = and b =

a) Are the vectors a and b perpendicular? (please explain your answer)

b) Find a vector perpendicular to a **and** b.

c) Find a vector form of the line perpendicular to a and b that passes through the point (1, 0, 1).

Answer 2

a) **.** = 2 + 12 + 8 = 22 so they are not perpendicular

b) X = = 5\*

c)

EXERCISE 3

Given are the vectors a = and b =

Now **V** is a planeparallel to vectors a and b through the Origin.

Give a linear equation for this plane V.

Answer 3

V:

b) X = equation: -8x + 7y –2z = 0

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EXERCISE 3 *(6+6+6 points)*

Given are the three points A = (3,5,7), B = (-1,2,0) and C = (4,7,1)

a. Give a vector-form of the plane V through these three points.

b. Give an equation of V.

c. Give the vector-form of the line perpendicular to V through A.

3. a. A−B =, C−B = , so the vector-form can be: +λμ  
 b. Calculate the cross product =   
 These are the coefficients of the equation: -32x+31y+5z=c  
 Substitute one of the points to calculate c: -32(3)+31(5)+5(7)=94=c  
 The equation of V is -32x+31y+5z=94  
 c. +λ

EXERCISE 4 *(7 points)*

Given are the lines *l:*  = + λ and *m:*  = + μ

Find the intersection-point of the two lines (if there is such an intersection point).

4. Three equations: 2+λ = 1+3μ  
 -5+2λ=9-2μ  
 -1+λ=2+μ  
 Solution is λ=5 and μ=2. This gives the intersection-point (7,5,4)

Languages: topics: Finite State Machines (FSM), conversion of graph to FSA

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EXERCISE 7 *(13 points)*

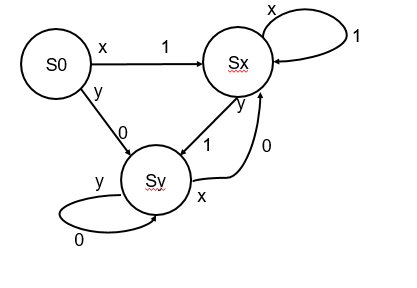
Given the input alphabet A={x,y} and the output alphabet Z={0,1}.

There is a finite state machine M such that

* Any x preceded by an y will be changed into 0
* All other x’s will be changed into 1
* Any y preceded by an x will be changed into 1
* All other y’s will be changed into 0

So the input string xxyx will be converted into 1110

Give the state diagram (= graph) of the finite state machine M.



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EXERCISE 8 *(3+4+4 points)*

|  |  |  |
| --- | --- | --- |
| **F** | ***x*** | **y** |
| **S0** | S1 , 1 | S0 , 0 |
| **S1** | S2 , 2 | S0 , 0 |
| **S2** | S2 , 3 | S0 , 0 |

This is the state table of the finite state machine M. S0 is the initial state.

a. Mention:

1. the set A of input symbols
2. the set S of states

(iii) the set Z of output symbols

b. Determine the output string if the input string is *yxyxxx*.

c. Can you find an input-string for which the output-string contains the subword 03?  
 **Explain your answer.**

8. a. A={x,y} S={S0 , S1 , S2 } Z={0,1,2,3}  
b. 010123  
c. No, 3 is only possible from node S2. But you cannot arrive there with a zero, only   
 with a 2. So before the 3 there must be a 2.

EXERCISE 8 *( 5+5 points)*

This is the state table of the finite state machine M. S0 is the initial state:

x y

s0 s1, 0 s2, 0

s1 s1, 1 s2, 0

s2 s0, 1 s1, 1

a. Draw a diagram for this M

b. Give the output string if the input string is xxyxy.

***1***

***x***

***x 0***

8. a.

***1***

***0***

***1***

***y***

***y***

***x***

***0***

***y***

S2

S1

S0

b. 01010