Exam Programming in MATLAB

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Problem 1 Matlab basics

This problem is based on the following code

```
1  function m = funcEx1(x)
2    [n1, n2] = size(x);
3    if n1 > 1 && n2 > 1
4      error('x is not a vector')
5    end

6    m = zeros(n1, n2);
7    n = 1;
8    while n <= length(x)
9      if x(n) < 0
10       m(n) = -x(n);
11     else
12       m(n) = x(n);
13     end
14     n = n + 1;
15   end
```

a) Write a help description for this function. Could you think of another name for this function that is more descriptive?

b) Consider the following input statements. What does MATLAB return?

(1)
```
y = zeros(5,1);
a = funcEx1(y)
```

(2)
```
y = [-1 -2 -3 -4 -5];
a = funcEx1(y)
```

(3)
```
x = [1 -2 3; 4 -5 6];
a = funcEx1(x)
```

c) Replace the `while`-loop by a `for`-loop.

d) Change the code such that it can also handle matrices. Do not use any loops.

e) What is the value of `a`, `b` en `c`, starting with the following initial values for `a`: 1, 2, 2.5, 3, 4?

```
1  b = 2;
2  if a <= 2
3    c = 4;
4  elseif a + b < 4
5   c = 3;
6  else
7   c = a + b;
8  end
9  for i = a:c
10   b = b + 1;
11 end
12 while a < 3
13   a = a + 2;
14 end
```

Problem 2 Improve the code

a) Find the six errors in the code below. Indicate for each error (i) where (line number) and why the error occurs, (ii) the type of error (syntax, runtime, logic), and (iii) a replacement code.

```
1  function (y, i) = MINIMUM(x)
2  % minimum gives the minimum value of vector x and
3  % index where the minium occurs.
4    y = x(1);
5    i = 1;
6    for k = 0:length(x)
7      if x(k) > y
8        Y = x(k);
9        i == k;
10     end
```

b) Improve the following code by (i) taking out all unnecessary dot operations, and by (ii) removing all unnecessary statements and variables.

```
1 function [dCdT] = diffeqs(C,k)
2   k1 = k(1);
3   k2 = k(2);
4   k3 = k(3);

5   concA = C(1);
6   concB = C(2);
7   concC = C(3);
8   concD = C(4);

9   diffA = -k1.*concA.*concB -k2.*concA.*concC + k3.*concD.*concB;
10  diffB = -k3.*concB.*concD + k2.*concC.*concA - k1.*concB.*concA;
11  diffC = k1.*concA.*concB - k2.*concA.*concC;
12  diffD = -k3.*concB.*concD + k1.*concA.*concB;

13  dCdT=[diffA diffB diffC diffD];
```

Problem 3 Solving a problem

At low temperatures the heat capacity C varies with temperature T. The following relation can be used

$$C(T) = \gamma T + \sum_{i=3,5,7} B_i T^i.$$

The file `data.dat` consists of four columns which contain temperature and the heat capacities of Fe_3O_4, CoO en Al_2O_3 at these temperatures.

a) How many fitting parameters will be obtained per compound? What is the minimum number of data points required for a reasonable fit?

b) Write a script that reads in the data file and returns the value for γ voor the three different compounds.