1 Problem 1

In floating point arithmetic $a + b == a$ when $|b| < \epsilon|a|$.
Which of the following statements is False:
MISSING...

2 Problem 2

Consider the following functions:

$$f_1(x) = \frac{2}{x^2 - 1} - \frac{1}{x - 1}$$

$$f_2(x) = \frac{-1}{1 + x}$$

Assuming floating point arithmetics, which of the following statments is False:
MISSING...

3 Problem 3

Consider these numbers: $x_0 = 1 + a$, $x_1 = 1 - a$ for $x_i = 1$ for $i = 2...N - 1$ and $a = 10^{-3}$. The average is $\mu = 1$ and the variance is $\sigma^2 = 2a^2/N$.
Assume single precision floating point arithmetics and assume you compute the variance using the formula:

$$\sigma^2 = (\frac{1}{N}\sum_i x^2) - \mu^2$$

MISSING...

4 Problem 4

Consider the following matrix:
MISSING...
Compute the inverse in 6 steps. Show your steps.

5 Problem 5

Consider the following 2×2 matrix:

$$\begin{pmatrix} 1 & a \\ a & 2 \end{pmatrix}$$

MISSING...

6 Problem 6

Consider the following algorithms:

```
def D(f,h=1e-4):
    return lambda x: (f(x+h)-f(x-h))/(2.0*h)

def P(f,x,ns=10):
    for k in range(ns): x = x - f(x)/D(f)(x)
    return x

def Q(f,x,ns=10):
    for k in range(ns): x = x - f(x)/D(D(f))(x)
    return x
```

Which of the following statments are False (more then one are false):
MISSING...

7 Problem 7

What is the output of
MISSING...
Show your steps.

8 Problem 8

Consider the following algorithms:

```
def R(f,x,ap=1e-5,rp=1e-5,h=1e-4):
    while True:
        (x_old, x) = (x, x - f(x)*h/(f(x)-f(x-h)))
        if abs(x-x_old)<max(ap,rp*abs(x)): return x

def S(f,x,ap=1e-5,rp=1e-5,h=1e-4):
    while True:
        fx = f(x)
        (x_old, x) = (x, x - fx*h/(fx-f(x-h)))
        if abs(x-x_old)<max(ap,rp*abs(x)): return x

def T(f,x,ap=1e-5,rp=1e-5,h=1e-4):
    fx = f(x)
    (x_old, fx_old, x) = (x, fx, x - fx*h/(fx-f(x-h)))
    while True:
        fx = f(x)
        (x_old, fx_old, x) = (x, fx, x - fx*(x-x_old)/(fx-fx_old))
        if abs(x-x_old)<max(ap,rp*abs(x)): return x
    return x
```

Which of the following statements are False:
MISSING...

9 Problem 9

Consider the following three points:
MISSING...
You perform a linear fit using the linear least square algorithm with $y = c_1 t + c_0$. The output is given by $c = (A^t A)^{-1} A^t y$. Where $A_{i0} = t_i$, $A_{i1} = 1$. Using the fact that

$$\begin{pmatrix} \text{a} & 1 \\ 1 & 1 \end{pmatrix}^{-1} = \frac{1}{a-1} \begin{pmatrix} 1 & \text{-1} \\ \text{-1} & \text{a} \end{pmatrix}$$

determine the value of the coefficients c. Show your steps.

10 Problem 10

Which of the following statements is False:
MISSING...