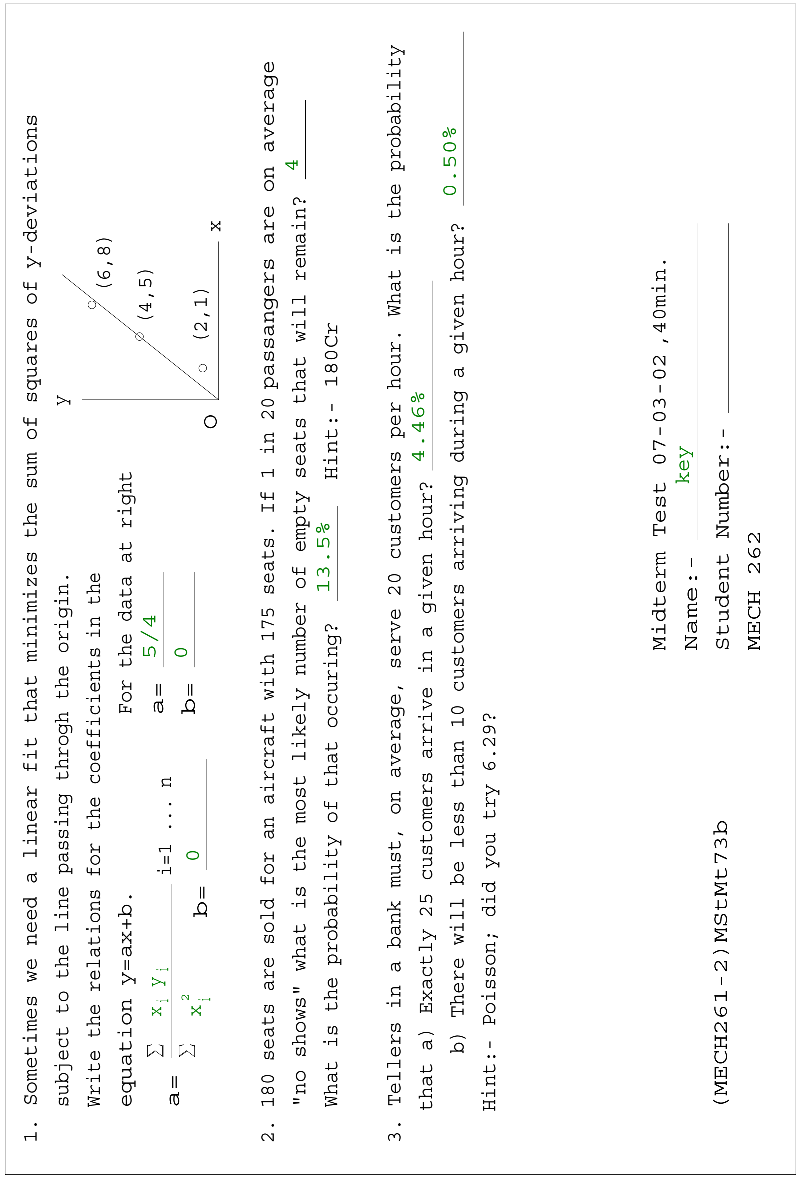

1. Sometimes we need a linear fit that minimizes the sum of squares of y-deviations subject to the line passing throgh the origin. Write the relations for the coefficients in the equation y=ax+b. For the data at right

$a = \frac{\sum x_i y_i}{\sum x_i^2}$ i=1 ... n   a= 5/4

b= 0   b= 0

2. 180 seats are sold for an aircraft with 175 seats. If 1 in 20 passangers are on average "no shows" what is the most likely number of empty seats that will remain? 4

What is the probability of that occuring? 13.5%   Hint:- 180Cr

3. Tellers in a bank must, on average, serve 20 customers per hour. What is the probability that a) Exactly 25 customers arrive in a given hour? 4.46%

b) There will be less than 10 customers arriving during a given hour? 0.50%

Hint:- Poisson; did you try 6.29?

Midterm Test 07-03-02 ,40min.

Name:- key

Student Number:-

MECH 262

(MECH261-2)MStMt73b

Figure 1: Midterm Test 07-03-02

```
> restart:with(combinat):
```

Warning, the protected name Chi has been redefined and unprotected

```
> a:=(2*1+4*5+6*8)/(2^2+4^2+6^2);
```

$$a := \frac{5}{4}$$

A least squares linear fit that is forced to go through the origin requires only one degree of freedom, i.e., a, the slope of the line. This is computed as the sum of the products of the point coordinates divided by the sum of the squares of the x-coordinates. This is question 1 on the 2007 MECH 262 midterm test.

```
> numbcomb(180,7)*.05^7*.95^173;
```

$$0.1180760941$$

```
> numbcomb(180,8)*.05^8*.95^172;
```

$$0.1343892387$$

```
> numbcomb(180,9)*.05^9*.95^171;
```

$$0.1351751406$$

```
> numbcomb(180,10)*.05^10*.95^170;
```

$$0.1216576265$$

This is an iterative solution to the "rotten egg" problem to find the most likely (highest probability) number in a binomially distributed sample of 180 "events" with a probability of 1/20. This is a unimodal distribution function, i.e., it has a single peak or maximum. We see this is the probability of 9 "no-shows" at about 13.5%. Sorry, I subtracted 175-(180-9)=2, the wrong answer. It should have been 4 empty seats.This is question 2 on the 2007 MECH 262 midterm test.

```
> P25:=exp(-20)*20^25/25!;evalf(P25);
```

$$P25 := \frac{5120000000000000000000}{236682282155319} e^{(-20)}$$

$$0.04458764909$$

```
> P0:=evalf(exp(-20)*20^0/0!);P1:=evalf(exp(-20)*20^1/1!);P2:=evalf(exp
> (-20)*20^2/2!);P3:=evalf(exp(-20)*20^3/3!);P4:=evalf(exp(-20)*20^4/4!)
> ;P5:=evalf(exp(-20)*20^5/5!);P6:=evalf(exp(-20)*20^6/6!);P7:=evalf(exp
> (-20)*20^7/7!);P8:=evalf(exp(-20)*20^8/8!);P9:=evalf(exp(-20)*20^9/9!)
> ;
```

$$P0 := 0.2061153622\, 10^{-8}$$

$$P1 := 0.4122307244\, 10^{-7}$$

$$P2 := 0.4122307244\, 10^{-6}$$

$$P3 := 0.2748204829\, 10^{-5}$$

$$P4 := 0.00001374102415$$

$$P5 := 0.00005496409659$$

$$P6 := 0.0001832136553$$

$$P7 := 0.0005234675866$$

$$P8 := 0.001308668966$$

$$P9 := 0.002908153258$$

```
> P0to9:=P0+P1+P2+P3+P4+P5+P6+P7+P8+P9;
```

$$P0to9 := 0.004995412306$$

```
> P10:=evalf(exp(-20)*20^10/10!);
```

$$P10 := 0.005816306518$$

```
> P0to9+P10;
```

$$0.01081171882$$

The bank problem is suited to a Poisson distribution model. We get about 4.46% probability that exactly 25 customers will arrive in an hour long period if the average number of arrtivals is 20 per hour. The probability that less than 10 will arrive is computed as the sum of the probability of exactly 0,1,2,3,4,5,6,7,8,9 arrivals. Unfortunately added the probability of exactly 10 arraivals as well to get about 1.08% probability. The answer should have been about 0.5%.(MECH261-2)MStMt73b.mws. Recomputed 07-03-03.