

## เอกสารอ้างอิง

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สารเคมี

Chromosome medium 4

Component	gm/liter
NaCl	4.9742
KCl	0.308
MgSO <sub>4</sub> ·7H <sub>2</sub> O	0.154
NaH <sub>2</sub> PO <sub>4</sub> ·H <sub>2</sub> O	1.078
NaHCO <sub>3</sub>	1.694
Glucose	2.310
L-Tryptophan	0.0031
L-Phenylalanine	0.0165
L-Tyrosine	0.0181
L-Arginine. HCl	0.0421
L-Histidine.HCl.H <sub>2</sub> O	0.02096
L-Lysine.HCl	0.0365
L-Cysteine	0.0315
L-Methionine	0.0149
L-Isoleucine	0.03936
L-Leucine	0.03936
L-Valine	0.0176
L-Threonine	0.0176
L-Glutamine	0.02192
L-Asparagine	0.045
Glycine	0.0075

L-Serine	0.0263
L-Alanine	0.0139
L-Proline	0.0173
L-Hydroxyproline	0.0197
L-Aspartic acid	0.01997
L-Glutamic acid	0.0221
Thiamine.HCl	0.0002
Riboflavin	0.0002
Pyridoxal.HCl	0.0005
Pyridoxine.HCl	0.0005
Niacin	0.0005
Niacinamide	0.0005
D-Ca Pantothenate	0.0002
Biotin	0.0002
Folic acid	0.01
Choline chloride	0.005
i-Inosital	0.036
Para-Aminobenzoic acid	0.001
Ascorbic acid	0.0005
Vitamin B <sub>12</sub>	0.002
Phenol Red	0.01
Bacto-Peptone	0.6
Penicillin (base) utilizing	50,000
Penicillin G. Sodium	units/liter
Streptomycin(base) utilizing	50,000
Streptomycin Sulfate	mcg/liter



Neomycin (base) utilizing	100,000
Neomycin Sulfate	mcg/liter
Phytohemagglutinin	10 ml/liter
(M Form)	
Sodium Heparin	50,000
	units/liter
Fetal Bovine Serum	300 ml added
	to 1 liter of
	media. Total
	volum = 1.3 lit.
Giemsa stain	
Giemsa (Gurr)	2 ml.
Buffer's. SSC	2 ml.
น้ำกลั่น	46 ml.
Saline Sodium Citrate Buffer Solution (SSC)	
1.5 M NaCl	17.53 gm.
0.15 M Trisodium citrate	8.82 gm.
ปรับ pH ให้ได้	6.8
เติมน้ำกลั่น	1000 ml.
Hypotonic Solution	
KCl	5.6 gm.
น้ำกลั่น	1000 ml.



จำนวนโครโมโซมที่ผิดปกติทั้งหมดในปริมาณรังสีที่ได้รับขนาดต่างๆ กัน

นำมาคำนวณหาค่าทางสถิติ

Randomized Complete Block Design

Analysis is based on values transformed to SQR (X)

จำนวนซ้ำ (Rep.) = 10

จำนวน treatment = 6

Treatment name :	T <sub>1</sub>	=	0
	T <sub>2</sub>	=	200
	T <sub>3</sub>	=	400
	T <sub>4</sub>	=	800
	T <sub>5</sub>	=	1,60
	T <sub>6</sub>	=	3,200

	T <sub>1</sub>	T <sub>2</sub>	T <sub>3</sub>	T <sub>4</sub>	T <sub>5</sub>	T <sub>6</sub>	Transf'd Rep. Mean.	Actual Rep. Mean.
Rep. 1)	3	13	23	31	36	39	4.6577	24.1667
Rep. 2)	3	16	24	28	34	39	4.6664	24.0000
Rep. 3)	6	12	25	25	33	34	4.5815	22.5000
Rep. 4)	3	13	25	30	33	39	4.6341	23.8333
Rep. 5)	3	11	26	27	34	37	4.5429	23.0000
Rep. 6)	1	12	21	29	34	39	4.4180	22.6667
Rep. 7)	2	15	25	28	33	37	4.5677	23.3333
Rep. 8)	4	13	23	28	34	37	4.6011	23.1667
Rep. 9)	4	15	22	28	36	30	4.5554	22.5000
Rep. 10)	5	14	22	30	35	37	4.5907	23.8333

Transf'd. Trt. Means :

1.8028 3.6549 4.8553 5.3270 5.8474 6.0610 4.5915

Actual. trt. Means.

3.4000 13.4000 23.6000 28.4000 34.2000 36.8000 23.3000

## Analysis of Variance

S.V.	D.F.	Sum of Squares	Mean Squares	F-value
Total	59	133.0648192		
Replication	9	0.3371211220	0.03745790244	
Treatments	5	130.0386764	26.00773528	435.23**
Error	45	2.689021739	0.5975603864	

Coeff. of variation = 5.3 %

การวางของ means (เฉลี่ย 10 ชั่วโมง)

Treatment no.	Treatment name	Rank	Mean	DMRT
1	0	1	3.4000	a
2	200	2	13.4000	b
3	400	3	23.6000	c
4	800	4	28.4000	d
5	1,600	5	34.2000	e
6	3,200	6	36.8000	e
Grand Mean			23.3000	✓

Means followed by a common letter are not significantly different at the 5 % level by DMRT

จำนวนโครโมโซมที่ผิดปกติทั้งหมดในปริมาณรังสีที่ได้รับขนาดต่าง ๆ กัน  
นำมาคำนวณหาค่าทางสถิติ

จำนวนซ้ำ = 4

จำนวน treatments = 7

treatments name : T<sub>1</sub> = 0  
T<sub>2</sub> = 200  
T<sub>3</sub> = 400  
T<sub>4</sub> = 800  
T<sub>5</sub> = 1,600  
T<sub>6</sub> = 3,200  
T<sub>7</sub> = 4,000

	Rep.1	Rep.2	Rep.3	Rep.4	Transf'd Treat.mean.	Actual Treat.meane.
T <sub>1</sub> )	6	3	4	5	2.1044	4.5000
T <sub>2</sub> )	12	11	15	14	3.5988	13.0000
T <sub>3</sub> )	25	26	22	22	4.8700	23.7500
T <sub>4</sub> )	25	27	28	30	5.2412	27.5000
T <sub>5</sub> )	33	34	36	35	5.8729	34.5000
T <sub>6</sub> )	34	37	30	37	5.8684	34.5000
T <sub>7</sub> )	34	33	36	37	5.9146	35.0000

Transf'd Rep. Mean :

4.7600    4.7146    4.7617    4.8896    4.7815

Actual Rep. Mean :

24.1429    24.4286    24.4286    25.7143    24.6786



## Analysis of Variance

S.V.	D.F.	Sum of squares	Mean squares	F. value
Total	27	50.85009042		
Replication	3	.1190577780	0.03968592600	
Treatments	6	49.76442354	8.294070590	154.45 **
Error	18	.9666091072	0.05370050595	

Coeff. of Variation = 4.8 %

การวาง Means (เฉลี่ย 4 ท่า)

Trt. no.	Treatment name	Rank	Mean	DMRT
1	0	1	4.5000	a
2	200	2	13.0000	b
3	400	3	23.7500	c
4	800	4	27.5000	d
5	1,600	5	34.5000	e
6	3,200	6	34.5000	e
7	4,000	7	35.0000	e
Grand mean			24.6786	

Means followed by a common letter are not significantly different at the 5 % level by DMRT

จำนวนโครโมโซมที่ทั้งหมด ในปริมาณรังสีที่ได้รับขนาดต่าง ๆ กัน นำมา  
คำนวณหาค่าทางสถิติ

Randomized Complete Block Design

Analysis is based on values transformed to SQR (X)

จำนวนซ้ำ = 10

จำนวน treatments = 6

Treatment name :

T<sub>1</sub> = 0  
T<sub>2</sub> = 200  
T<sub>3</sub> = 400  
T<sub>4</sub> = 800  
T<sub>5</sub> = 1,600  
T<sub>6</sub> = 3,200

	T <sub>1</sub>	T <sub>2</sub>	T <sub>3</sub>	T <sub>4</sub>	T <sub>5</sub>	T <sub>6</sub>	Transf'd Rep.Mean	Actual Rep.Mean
Rep. 1)	3 <sup>1</sup>	8 <sup>2</sup>	15 <sup>3</sup>	16 <sup>4</sup>	20 <sup>5</sup>	22 <sup>6</sup>	3.5993	14.0000
Rep. 2)	3	11	11	15	19	20	3.5116	13.1667
Rep. 3)	6	8	14	11	21	21	3.5836	13.5000
Rep. 4)	3	9	14	15	18	24	3.5814	13.8333
Rep. 5)	3	8	13	10	21	21	3.4156	12.6667
Rep. 6)	1	8	11	16	20	21	3.3666	12.8333
Rep. 7)	2	9	12	15	18	21	3.4294	12.8333
Rep. 8)	4	8	13	17	18	19	3.5264	13.1667
Rep. 9)	4	8	13	14	18	14	3.3600	11.8333
Rep. 10)	5	9	11	15	20	20	3.5617	13.3333

Transf'd. Trt. Means:

1.8028 2.9287 3.5587 3.7836 4.3911 4.4965 3.4936

Actual. trt. Means :

3.4000 8.6000 12.7000 14.4000 19.3000 20.3000 13.1167

## Analysis of Variance

S.V.	D.F.	Sum of squares	Mean squares	F-value
Total	59	54.7048458		
Replication	9	0.4631525244	0.0514613916	
Treatments	5	50.77441275	10.15488255	131.79**
Error	45	3.467289306	0.97705087347	

Coeff. of Variation = 7.9 %

การวาง means (เฉลี่ย 10 ครั้ง)

Trt. no.	Treatment name	Rank	Mean	DMRT
1	0	1	3.4000	a
2	200	2	3.6000	b
3	400	3	12.7000	c
4	800	4	14.4000	c
5	1,600	5	19.3000	d
6	3,200	6	20.3000	d
Grand Mean			13.1167	

Means followed by a common letter are not significantly different at the 5 % level by DMRT.



จำนวนโครโมโซมที่หักทั้งหมด ในปริมาณรังสีที่ได้รับขนาดต่าง ๆ กัน นำมา  
คำนวณหาค่าทางสถิติ

จำนวนซ้ำ = 4

จำนวน treatment = 7

Treatment name : T<sub>1</sub> = 0  
T<sub>2</sub> = 200  
T<sub>3</sub> = 400  
T<sub>4</sub> = 800  
T<sub>5</sub> = 1,600  
T<sub>6</sub> = 3,200  
T<sub>7</sub> = 4,000

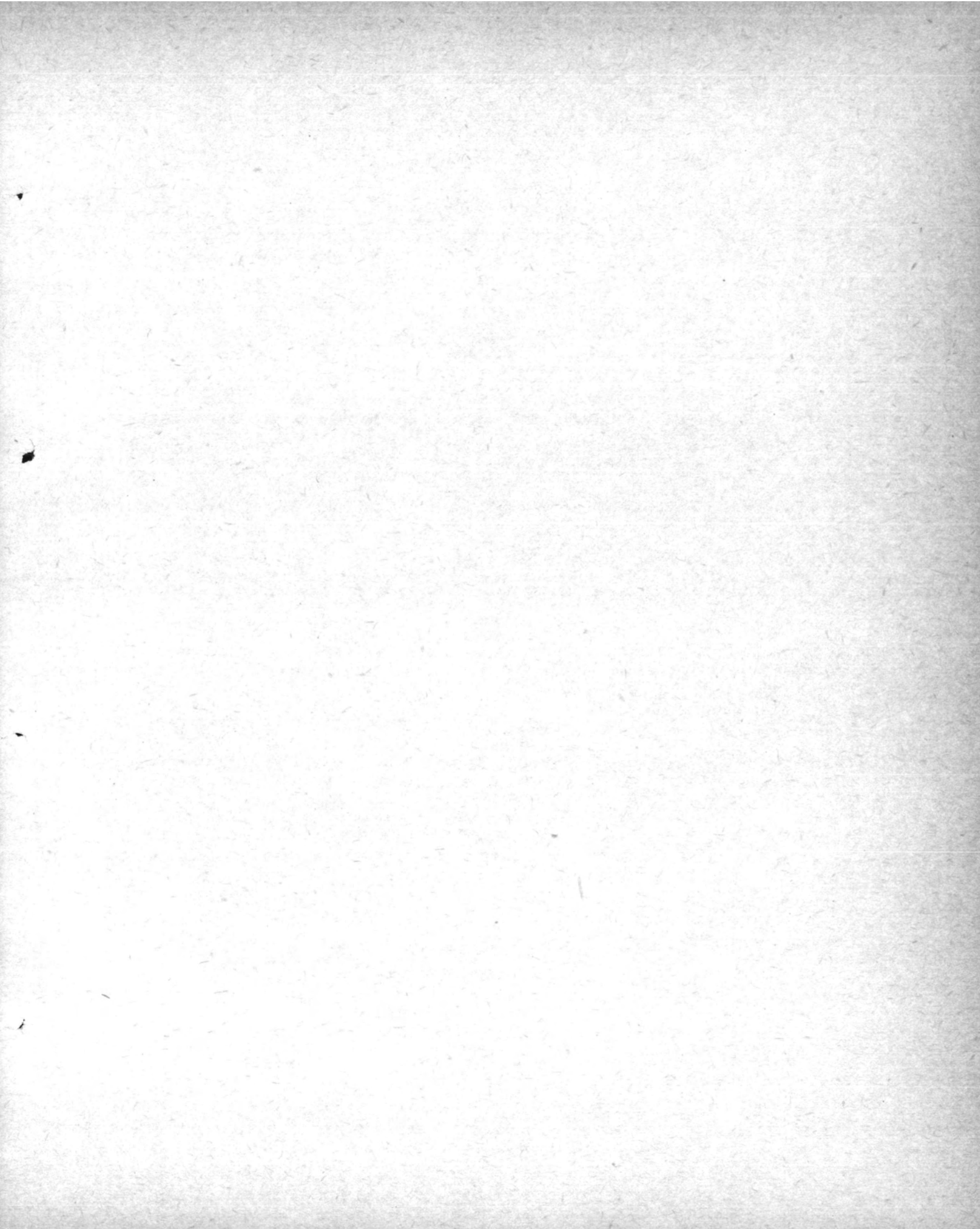
	Rep.1	Rep. 2	Rep.3	Rep.4	Transf'd Trt.Mean.	Actual Trt.Mean.
T <sub>1</sub> )	6	3	4	5	2.1044	4.5000
T <sub>2</sub> )	8	8	8	9	2.8713	8.2500
T <sub>3</sub> )	14	13	13	11	3.5673	12.7500
T <sub>4</sub> )	11	10	14	15	3.5234	12.5000
T <sub>5</sub> )	21	21	18	20	4.4700	20.0000
T <sub>6</sub> )	21	21	14	20	4.3447	19.0000
T <sub>7</sub> )	17	17	22	21	4.3798	19.2500

Transf'd Rep. Means.

3.6606      3.5167      3.5500      3.7075      3.6087

Actual Rep. Means :

14.0000      13.2857      13.2857      14.4286      13.7500



## Analysis of Variance

S.V.	D.F.	Sum of squares	Mean squares	F-value
Total	27	20.36184393		
Replication	3	.1706052858	0.05684286	
Treatments	6	18.77512679	3.129187798	39.77**
Error	18	1.416111856	0.0786728809	

Coeff. of Variation = 7.8 %

ตาราง Means (เฉลี่ย 4 ซ้ำ)

Trt. no.	Treatment name	Rank	Mean	DMRT
1	0	1	4.5000	a
2	200	2	8.2500	b
3	400	3	12.7500	c
4	800	4	12.5000	e
5	1,600	7	20.0000	d
6	3,200	5	19.0000	d
7	4,000	6	19.2500	d
Grand Mean			13.7500	

Means followed by a common letter are not significantly different at the 5% level by DMRT.



จำนวน dicentric chromosome ในปริมาณรังสีที่ได้รับขนาดต่าง ๆ กัน  
นำมาคำนวณหาค่าทางสถิติ

Randomized Complete Block Design

Analysis is based on values transformed to

SOR (X)

จำนวนซ้ำ = 10

จำนวน treatment = 6

Treatment names :

T<sub>1</sub>) = 0  
T<sub>2</sub>) = 200  
T<sub>3</sub>) = 400  
T<sub>4</sub>) = 800  
T<sub>5</sub>) = 1,600  
T<sub>6</sub>) = 3,200

	T <sub>1</sub>	T <sub>2</sub>	T <sub>3</sub>	T <sub>4</sub>	T <sub>5</sub>	T <sub>6</sub>	Transf'd Rep. Mean	Actual Rep. Mean.
Rep.1)	0	5	6	10	12	12	2.4627	7.5000
Rep.2)	0	4	10	10	11	13	2.5411	8.0000
Rep.3)	0	4	10	11	8	10	2.4116	7.1667
Rep.4)	0	4	8	11	10	12	2.4619	7.5000
Rep.5)	0	2	10	12	10	12	2.4445	7.6667
Rep.6)	0	3	7	10	10	14	2.4973	7.3333
Rep.7)	0	4	10	11	11	13	2.5668	8.1667
Rep.8)	0	4	8	8	13	13	2.4780	7.6667
Rep.9)	0	6	7	10	14	12	2.5772	8.1667
Rep.10)	0	4	9	11	10	12	2.4905	7.6667



Transf'd Trt. Means :

0.0000 1.9832 2.9047 2.2208 3.2922 3.5041 2.4842

Actual. Trt. Means:

0.0000 4.0000 8.5000 10.4000 10.5000 12.3000 7.6833

Analysis of Variance

S.V.	D.F.	Sum of squares	Mean squares	F-value
Total	59	90.73439959		
Replication	9	0.1950946458	0.02167718286	
Treatments	5	88.34780648	17.66956129	362.82**
Error	45	2.191498468	0.04869996595	

Coeff. of Variation = 8.9 %

ตาราง Mean (เฉลี่ย 10 ซ้ำ)

Trt. no.	Treatment name	Rank	Mean	DMRT
1	0	1	0.0000	a
2	200	2	4.0000	b
3	400	3	8.5000	c
4	800	4	10.4000	d
5	1,600	5	10.9000	d
6	3,200	6	12.3000	e
Grand mean			7.67	

Means followed by a common letter are not significantly different at the 5 % level by DMRT

จำนวน dicentric chromosome ในปริมาณรังสีที่ได้รับขนาดต่าง ๆ กัน  
นำมาคำนวณหาค่าทางสถิติ

จำนวนซ้ำ = 4

จำนวน treatment = 7

Treatment names :

T<sub>1</sub>) = 0  
T<sub>2</sub>) = 200  
T<sub>3</sub>) = 400  
T<sub>4</sub>) = 800  
T<sub>5</sub>) = 1,600  
T<sub>6</sub>) = 3,200  
T<sub>7</sub>) = 4,000

	Rep.1	Rep.2	Rep.3	Rep.4	Transf'd Trt.Mean	Actual Trt.Mean.
T <sub>1</sub> )	0	0	0	0	0.0000	0.0000
T <sub>2</sub> )	4	2	6	4	1.9659	4.0000
T <sub>3</sub> )	10	10	7	9	2.9926	9.0000
T <sub>4</sub> )	11	12	10	11	3.3149	11.0000
T <sub>5</sub> )	8	10	14	10	3.2237	10.5000
T <sub>6</sub> )	10	12	12	12	3.3886	11.5000
T <sub>7</sub> )	12	12	12	12	3.4641	12.0000

Transf'd. Rep. Means :

2.5620    2.5902    2.7039    2.6296    2.6214

Actual. Rep. Means.

7.8571    8.2857    8.7148    8.2857    8.2857



## Analysis of Variance

S.V.	D.F.	Sum of squares	Mean squares	F.Value
Total	27	39.59098275		
Replication	3	0.079635499	0.02656451663	
Treatments	6	38.32655055	6.387758426	97.05**
Error	18	1.184738646	0.06581881368	

Coeff. of Variation = 9.8 %

ตาราง Means ( จำนวนซ้ำ 4 ซ้ำ )

Trt. no.	Treatment name	Rank	Mean	DMRT
1	0	1	0.0000	a
2	200	2	4.0000	b
3	400	3	9.0000	c
4	800	5	11.0000	cd
5	1,600	4	10.5000	cd
6	3,200	6	11.5000	cd
7	4,000	7	12.0000	d
Grand mean			8.28	

Means followed by a common letter are not significantly different at the 5 % level by DMRT.

จำนวน acentric chromosome ในปริมาณรังสีที่ได้รับขนาดต่าง ๆ กัน  
นำมาคำนวณหาค่าทางสถิติ

Randomized Complete Block Design

Analysis is based on values transformed to SQR (X)

จำนวนซ้ำ = 10

จำนวน treatment = 6

Treatment name :

T<sub>1</sub> = 0  
T<sub>2</sub> = 200  
T<sub>3</sub> = 400  
T<sub>4</sub> = 800  
T<sub>5</sub> = 1,600  
T<sub>6</sub> = 3,200

	T <sub>1</sub>	T <sub>2</sub>	T <sub>3</sub>	T <sub>4</sub>	T <sub>5</sub>	T <sub>6</sub>	Transf'd Rep.Mean	Actual Rep.Mean
Rep.1)	0	0	2	4	4	4	1.2357	2.3333
Rep.2)	0	1	3	3	4	5	1.4500	2.6667
Rep.3)	0	0	1	3	4	2	1.0244	1.6667
Rep.4)	0	0	3	4	4	3	1.2440	2.3333
Rep.5)	0	1	3	4	3	4	1.4107	2.5000
Rep.6)	0	1	3	3	4	4	1.4107	2.5000
Rep.7)	0	2	3	2	3	3	1.3374	2.1667
Rep.8)	0	1	2	3	3	5	1.3524	2.3333
Rep.9)	0	1	2	4	4	3	1.3577	2.3333
Rep.10)	0	1	2	3	5	5	1.4364	2.6667

Transf'd. Trt. Means :

0.0000 0.7414 1.5317 1.8074 1.9432 1.9310 1.3259

Actual Trt. Means :

0.0000 0.8000 2.4000 3.3000 3.8000 3.8000 2.3500

Analysis of Variance

S.V.	D.F.	Sum of squares	Mean squares	F.Value
Total	59	35.51251026		
Replication	9	0.897587051	0.0997319339	
Treatments	5	31.22141840	6.24428368	82.80**
Error	45	3.393504454	0.07541121009	

Coeff. of Variation = 20.7 %

การวาง means (เฉลี่ย 10 ซ้ำ)

Trt. no.	Treatment name	Rank	Mean	DMRT
1	0	1	0.0000	a
2	200	2	0.8000	b
3	400	3	2.4000	c
4	800	4	3.3000	d
5	1,600	5	3.8000	d
6	3,200	6	3.8000	d
Grand mean			2.3500	

Means followed by a common letter are not significantly different at the 5 % level by DMRT.



จำนวน acentric chromosome ในปริมาณรังสีที่ได้รับขนาดต่าง ๆ กัน  
นำมาคำนวณหาค่าทางสถิติ

จำนวน ซ้ำ = 4 ซ้ำ

จำนวน treatment = 7

Treatment name :

T<sub>1</sub> = 0  
T<sub>2</sub> = 200  
T<sub>3</sub> = 400  
T<sub>4</sub> = 800  
T<sub>5</sub> = 1,600  
T<sub>6</sub> = 3,200  
T<sub>7</sub> = 4,000

	Rep. 1	Rep. 2	Rep. 3	Rep. 4	Transf'd Trt. Mean	Actual Trt. Mean
T <sub>1</sub> )	0	0	0	0	0.0000	0.0000
T <sub>2</sub> )	0	1	1	1	0.7500	0.7500
T <sub>3</sub> )	1	3	2	2	1.3901	2.0000
T <sub>4</sub> )	3	4	4	3	1.8660	3.5000
T <sub>5</sub> )	4	3	4	5	1.9920	4.0000
T <sub>6</sub> )	2	4	3	5	1.8456	3.5000
T <sub>7</sub> )	4	4	2	4	1.8536	3.5000

Transf'd Rep. Means :

1.1638    1.4949    1.3658    1.569    1.3853

Actual. Rep. Means :

2.0000    2.7143    2.2857    2.8571    2.4643

## Analysis of Variance

S.V.	D.F.	Sum of squares	Mean squares	F-Value
Total	27	15.26409039		
Replication	3	0.551548904	0.1838496347	
Treatments	6	13.4120998	2.235349998	30.94**
Error	18	0.01300441504	0.07224675023	

Coeff. of Variation = 19.4 %

ตาราง Means (เฉลี่ย 4 ซ้ำ)

Trt. no.	Treatment name	Rank	Mean	DMRT
1	0	1	0.0000	a
2	200	2	0.7500	b
3	400	3	2.0000	c
4	800	4	3.5000	d
5	1,600	7	4.0000	d
6	3,200	5	3.5000	d
7	4,000	6	3.5000	d
Grand Mean			2.4643	

Means followed by a common letter are not significantly different at the 5 % level by DMRT.

คำนวณหาสหสัมพันธ์ และสมการรีเกรซัน ของจำนวนโครโมโซมที่ผิดปกติทั้งหมด  
(เฉลี่ย 10 ข้ำ)

## POLYNOMIAL REGRESSION ANALYSIS

PROJECT NAME : SAOWANEE'S JOB

RUN BY : SAMORN

DATE : 03/30/81

DATA FILE : DATA 1 # VOLUMES = 1

NO. OF OBSERVATIONS = 6

ORDER OF POLYNOMIAL = 2

## INPUT DATA :

OBS. #	X	Y	W
1	0	3.4	1
2	200	13.4	1
3	400	23.6	1
4	800	28.4	1
5	1600	34.2	1
6	3200	36.8	1

## POLYNOMIAL REGRESSION ANALYSIS

PROJECT NAME : SAOWANEE'S JOB

RUN BY : SAMORN

DATE: 03/30/81

DATA FILE: DATA 1 # VOLUMES = 1

NO. OF OBSERVATIONS = 6

ORDER OF POLYNOMIAL = 2



MEAN OF X AND Y :

1033.333333334 23.3

STD. DEV. OF X AND Y:

1202.774570178 12.81545941431

CORRELATION MATRIX:

1 .965755527661 .8156164105185  
 .965755527661 1 .6561592367552

COEFFICIENT OF MULTIPLE DETERMINATION = .9222156511154

CORRELATION COEFFICIENT = .9603205980897

ADJUSTED COEFFICIENT OF MULTIPLE DETERMINATION = .8703594185257

ADJUSTED CORRELATION COEFFICIENT = .9329305539673

S.S. ATTRIBUTABLE TO REGRESSION = 757.305048382

S.S. OF DEVIATION FROM REGRESSION = 63.874951617

VARIANCE OF ESTIMATE = 21.291650539

STD. ERROR OF ESTIMATE = 4.61428765239

ANALYSIS OF VARIANCE FOR THE POLYNOMIAL REGRESSION

SOURCE	D.F.	S.S.	M.S.
REGRESS.	2	757.305048382	378.652524191
RESIDUAL	3	63.874951617	21.291650539
TOTAL	5	821.179999999	

REGRESSION COEFFICIENT                      STD. ERROR                      T-VALUE

B(1)                      .0287956653225                      6.61264842E-03                      4.354634252511  
 B(2)                      6.22731854E-06                      1.97802709E-06                      -3.148247342566

B(0) = 7.70125000008

STD. ERROR OF B(0) = 3.333403684679

## TABLE OF RESIDUALS

X	Y	Y(CAL)	E(I)
0	3.4	7.7012500008	-4.30125000008
200	13.4	13.21129032264	.18870967736
400	23.6	18.22314516134	5.37685483866
800	28.4	-26.75229838711	1.64770161289
1,600	34.2	37.83237903221	-3.63237903221
3,200	36.8	36.07963709656	.72035290344

END OF PROGRAM

คำนวณหาสมมติพันธ์ และสมการรีเกรซชันของจำนวนโครโมโซม ที่ผิดปกติ  
ทั้งหมด (เฉลี่ย 4 ซ้ำ)

## POLYNOMIAL REGRESSION ANALYSIS

PROJECT NAME: SAOWANEE'S JOB

RUN BY : SAMORN

DATE: 03/30/81

DATA FILE: DATA 2 # VOLUMES = 1

NO. OF OBSERVATIONS = 7

ORDER OF POLYNOMIAL = 2

## INPUT DATA :

OBS. #	X	Y	W
1	0	4.5	1
2	0	13.0	1
3	400	23.75	1

## INPUT DATA:

OBS. #	X	Y	W
4	800	27.5	1
5	1,600	34.5	1
6	3,200	34.5	1
7	4,000	35	1

## POLYNOMIAL REGRESSION ANALYSIS

PROJECT NAME : SAOWANEE'S JOB

RUN BY: SAMORN

DATE: 03/30/81

DATA FILE: DATA2 # VOLUMES = 1

NO. OF OBSERVATIONS = 7

ORDER OF POLYNOMIAL = 2

MEAN OF X AND Y:

1457.142857142 24.67857142856

STD. DEV. OF X AND Y:

1569.349273698 11.91525133121

CORRELATION MATRIX:

1	.9735237120243	.7841566632691
.9735237120243	1	.6427738470937

COEFFICIENT OF MULTIPLE DETERMINATION = .8933523417922

CORRELATION COEFFICIENT = .9451731808469

ADJUSTED COEFFICIENT OF MULTIPLE DETERMINATION = .8400285126883

ADJUSTED CORRELATION COEFFICIENT = .9165306938059



S.S. ATTRIBUTABLE TO REGRESSION = 760.992620725

S.S. OF DEVIATION FROM REGRESSION = 90.846664991

VARIANCE OF ESTIMATE = 22.71166624775

STD. ERROR OF ESTIMATE = 765675843755

ANALYSIS OF VARIANCE FOR THE POLYNOMIAL REGRESSION

SOURCE	D.F.	S.S.	M.S.	F
REGRESS.	2	760.992620725	380.4963103625	16.75334192621
RESIDUAL	4	90.846664991	22.71166624775	
TOTAL	6	851.839285716		

REGRESSION COEFFICIENT      STD. ERROR      T-VALUE

B(1)	2.30166595E-02	5.42349869E-03	4.243876667589
B(2)	-4.32800059E-06	1.33924133E-06	-3.231680865987

B(0) 9.06600141775

STD. ERROR OF B(0) = 3.255728540671

TABLE OF RESIDUALS

X	Y	Y(CAL)	E(I)
0	4.5	9.46600141775	-4.96600141775
200	13	13.89621331117	-.89621331117
400	23.75	17.9801851568	5.7698148432
800	27.5	25.10940870467	2.39059129533
1600	34.5	35.2129752269	-.7129752269
3200	34.5	38.80058597727	-4.30058597727
400	35	32.28463020539	2.71536979461

END OF PROGRAM

คำนวณหาสหสัมพันธ์ และสมการถดถอยของจำนวนโครโมโซมที่หัก  
(เฉลี่ย 10 ซ้ำ)

## POLYNOMIAL REGRESSION ANALYSIS

PROJECT NAME: SAOWANEE'S JOB

RUN BY: SAMORN

DATE: 03/30/81

DATA FILE: DATA3 = VOLUMES = 1

NO. OF OBSERVATIONS = 6

ORDER OF POLYNOMIAL = 2

## INPUT DATA :

OBS.	X	Y	W
1	0	3.4	1
2	200	8.6	1
3	400	12.7	1
4	800	14.4	1
5	1600	19.3	1
6	3200	20.3	1

## POLYNOMIAL REGRESSION ANALYSIS

PROJECT NAME: SAOWANEE'S JOB

RUN BY: SAMORN

DATE: 03/30/81

DATA FILE: DATA3 # VOLUMES = 1

NO. OF OBSERVATIONS = 6

ORDER OF POLYNOMIAL = 2

MEAN OF X AND Y:

1033.333333334 13.1166666667

STD. DEV. OF X AND Y:

1202.774570178 6.426014835542

CORRELATION MATRIX:

1 .9657555276611 .8496950706074  
 .9657555276611 1 .6963274293978

COEFFICIENT OF MULTIPLE DETERMINATION = .951392895

CORRELATION COEFFICIENT = .9753937128155

ADJUSTED COEFFICIENT OF MULTIPLE DETERMINATION = 9189881583333

ADJUSTED CORRELATION COEFFICIENT = .9586387006236

S.S. ATTRIBUTABLE TO REGRESSION = 196.4325053755

S.S. OF DEVIATION FROM REGRESSION = 10.0358279575

VARIANCE OF ESTIMATE = 3.3452758585833

STD. ERROR OF ESTIMATE = 1.829009564172

ANALYSIS OF VARIANCE FOR THE POLYNOMIAL REGRESSION

SOURCE	D.F.	S.S.	M.S.	F
REGRESS.	2	196.4325053755	98.21625268775	29.35968604793
RESIDUAL	3	10.0358279575	3.345275985833	
TOTAL	5	206.468333333		

	REGRESSION COEFFICIENT	STD. ERROR	T-VALUE
B(1)	.0140647849462	2.62111903E-03	5.365946660581
B(2)	-2.95026881E+06	7.84049619E-07	-3.76285983052



$$B(0) = 5.290000000026$$

$$\text{STD. ERROR OF } B(0) = 1.32193269908$$

## TABLE OF RESIDUALS

X	Y	Y(CAL)	
0	3.4	5.290000000026	-1.890000000026
200	8.6	7.984946236578	.615053763422
400	12.7	10.44387096775	2.25612903225
800	14.4	14.65365591398	-.25369591398
1600	19.3	20.24096774192	-.94096774192
3200	20.3	20.08655913974	.21344086026

END OF PROGRAM

คำนวณหาสหสัมพันธ์ และสมการรีเกรชันของจำนวนโครโมโซมที่หัก  
(เฉลี่ย 4 ซ้ำ)

## POLYNOMIAL REGRESSION ANALYSIS

PROJECT NAME : SAOWANEE'S JOB

RUN BY: SAMORN

DATE: 03/30/81

DATA FILE: DATA# # VOLUMES = 1

NO. OF OBSERVATIONS = 7

ORDER OF POLYNOMIAL = 2

## INPUT DATA:

OBS. #	X	Y	W
1	0	4.5	1
2	200	8.25	1
3	400	12.75	1
4	800	12.5	1
5	1600	20	1
6	3200	19	1
7	4000	19.25	1

## POLYNOMIAL REGRESSION ANALYSIS

PROJECT NAME: SAOWANEE'S JOB

RUN BY: SAMORN

DATE: 03/30/81

DATA FILE: DATA4 # VOLUMES = 1

NO. OF OBSERVATIONS = 7

ORDER OF POLYNOMIAL = 2

MEAN OF X AND Y :

1457.142857142 13.75

STD. DEV. OF X AND Y:

1569.349273698 5.989574275355

CORRELATION MATRIX:

1	.9735237120243	.8209452134305
.9735237120243	1	.6855652210169

COEFFICIENT OF MULTIPLE DETERMINATION = .9211215887071

CORRELATION COEFFICIENT = .9597507951063



ADJUSTED COEFFICIENT OF MULTIPLE DETERMINATION = .8816823830606

ADJUSTED CORRELATION COEFFICIENT = .9389794369743

S.S. ATTRIBUTABLE TO REGRESSION = 198.2714219692

S.S. OF DEVIATION FROM REGRESSION = 16.9785780308

VARIANCE OF ESTIMATE = 4.2446445077

STD. ERROR OF ESTIMATE = 2.060253505688

ANALYSIS OF VARIANCE FOR THE POLYNOMIAL REGRESSION

SOURCE	D.F.	S.S.	M.S.	F
REGRESS.	2	198.2714219692	99.1357109846	23.35548025394
RESIDUAL	4	16.9785780308	4.2446445077	
TOTAL	6	215.25		

	REGRESSION COEFFICIENT	STD. ERROR	T-VALUE
B(1)	1.12143365E	2.34463748E-03	4.782972474199
B(2)	-2.04976599E-06	5.78968596E-07	-3.540375087367

B(0) = 6.088404493223

STD. ERROR OF B(0) = 1.407486862178

TABLE OF RESIDUALS

X	Y	&(CAL)	E(I)
0	4.5	6.088404493223	-1.588404493223
200	8.25	8.249281160649	.000718839351
400	12.75	10.24617654839	2.50382345161
800	12.5	13.74802348482	-1.24802348482
1600	20	18.78394200145	1.21605799855
3200	19	20.98467760985	-1.98467760985
4000	19.25	18.14949470162	1.10050529838

END OF PROGRAM



คำนวณหาสหสัมพันธ์ และสมการรีเกรชันของจำนวน dicentric chromosome  
(เฉลี่ย 10 ซ้ำ)

LYNOMIAL REGRESSION ANALYSIS

PROJECT NAME: A

RUN BY: S

DATE: 03/30/81

DATA FILE: DATA5 # VOLUMES = 1

NO. OF OBSERVATIONS = 6

ORDER OF POLYNOMIAL = 3

INPUT DATA:

OBS. #	X	Y	W
1	0	0	1
2	200	4	1
3	400	8.5	1
4	800	10.4	1
5	1600	10.3	1
6	3200	12.3	1

POLYNOMIAL REGRESSION ANALYSIS

PROJECT NAME: A

RUN BY: S

DATE: 03/30/81

DATA FILE: DATA5 # VOLUMES = 1

NO. OF OBSERVATIONS = 6

ORDER OF POLYNOMIAL = 3

MEAN OF X AND Y :

1033.333333334      7.58333333335

STD. DEV. OF X AND Y:

1202.774570178      4.663653789322

SUMS OF RAW DATA, POWERS, AND CROSS PRODUCTS:

6	6200	13640000	37448000000	45.5
6200	13640000	37448000000	1.11848000E+14	68360
13640000	37448000000	1.11848000E+14	3.46368320E+17	160496000
37448000000	1.11848000E+14	3.46368320E+17	1.09078534E+21	451136000000

SUM OF Y-SQUARED = 453.79

RESIDUAL SUMS:

7233333.333332	23353333333.33	7.31517333E+13	21343.33333332
23353333333.33	8.08397333E+13	2.61236533E+17	57059333.3333
7.31517333E+13	2.61236533E+17	8.57059893E+20	167155333333.3

RESIDUAL SUM OF Y-SQUARED = 108.748333333

CORRELATION MATRIX:

1	.9657555276611	.9290729064493	.7609948236599
.9657555276611	1	.9924665758679	.6085593679469
.9290729064493	.9924665758679	1	.5475242347187

COEFFICIENT OF MULTIPLE DETERMINATION = .9875477379515

CORRELATION COEFFICIENT = .9937543649975

ADJUSTED COEFFICIENT OF MULTIPLE DETERMINATION = .9688693448788

ADJUSTED CORRELATION COEFFICIENT = .9843116096434

S.S. ATTRIBUTABLE TO REGRESSION = 107.3941705893

S.S. OF DEVIATION FROM REGRESSION = 1.354162744

VARIANCE OF ESTIMATE = .677081372

STD. ERROR OF ESTIMATE = .8228495439629

ANALYSIS OF VARIANCE FOR THE POLYNOMIAL REGRESSION

SOURCE	D.F.	S.S.	M.S.	F
REGRESS.	3	107.3941705893	35.7980568631	52.87112944395
RESIDUAL	2	1.354162744	.677081372	
TOTAL	5	108.7483333333		

REGRESSION COEFFICIENT

B(1) .0250475813219 .0031059914194 8.064278980252

B(2) -1.67691810E-05 2.80508306E-06 -5.97814062542

B(3) 3.16851141E-09 6.04271574E-10 5.243522203112

B(0) = .047034867905

STD. ERROR OF B(0) = .7246288911617

COVARIANCE VALUES WITH B(0):

COV(B(0),B(1)) = -1.71445998E-03

COV(B(0),B(2)) = 1.28546802E-06

COV(B(0),B(3)) = -2.50415848E-10

COVARIANCE MATRIX (B(I),B(J)):

9.64718269E-06 -8.39795587E-09 1.73633692E-12

-8.39795587E-09 7.86849098E-12 -1.68157708E-15

1.73633692E-12 -1.68157708E-15 3.65144135E-19



## TABLE OF RESIDUALS

X	Y	Y(CAL)	E(I)
0	0	.047034867905	-.047034867905
200	4	4.411131983141	-.411131983141
400	8.5	7.585783165489	.914216834511
800	10.4	10.97510192389	-.57510192389
1600	10.3	10.17228436212	.12771563788
3200	12.3	12.30866369735	-.00866369735

ESTIMATE: X = 3200      Y = 12.30866369735

คำนวณหาสหสัมพันธ์ และสมการรีเกรชันของจำนวน dicentric  
chromosome ( เฉลี่ย 4 ซ้ำ )

## POLYNOMIAL REGRESSION ANALYSIS

PROJECT NAME: A

RUN BY: S

DATE: 03/30/81

DATA FILE: DATA6      # VOLUMES = 1

NO. OF OBSERVATIONS = 7

ORDER OF POLYNOMIAL = 4

## INPUT DATA :

OBS. #	X	Y	W
1	0	0	1
2	200	4	1
3	400	9	1

OBS. #	X	Y	W
4	800	11	1
5	1600	10.5	1
6	3200	11.5	1
7	4000	12	1

## POLYNOMIAL REGRESSION ANALYSIS

PROJECT NAME: A

RUN BY: S

DATE: 03/30/81

DATA FILE: DATA6 # VOLUMES = 1

NO. OF OBSERVATIONS = 7

ORDER OF POLYNOMIAL = 4

MEAN OF X AND Y:

1457.142857142 8.285714285712

STD. DEV. OF X AND Y:

1569.349273698 4.54475102781

CORRELATION MATRIX:

1	.9735237120243	.9388685474739	.9071814726507	.7077124948583
.9735237120243	1	.9913242365483	.9743874344865	.575249389739
.9388685474739	.9913242365483	1	.9952029025367	.5208917227645
.9071814726507	.9743874344865	.9952029025367	1	.4894090419741

COEFFICIENT OF MULTIPLE DETERMINATION = .9881892594692

CORRELATION COEFFICIENT = .994077089299

ADJUSTED COEFFICIENT OF MULTIPLE DETERMINATION = .9645677784076

ADJUSTED CORRELATION COEFFICIENT = .9821241155819

S.S. ATTRIBUTABLE TO REGRESSION = 122.4648832272

S.S. OF DEVIATION FROM REGRESSION = 1.4636882015

VARIANCE OF ESTIMATE = .73184410075

STD. ERROR OF ESTIMATE = .8554788721821

ANALYSIS OF VARIANCE FOR THE POLYNOMIAL REGRESSION

SOURCE	D.F.	S.S.	M.S.	F
REGRESS.	4	122.4648832272	30.6162208068	41.83434801951
RESIDUAL	2	1.4636882015	.73184410075	
TOTAL	6	123.9285714287		

	REGRESSION COEFFICIENT	STD. ERROR	T-VALUE
B( 1 )	.029831735232	3.84010098 E-03	7.768476744991
B( 2 )	-2.52183569E-05	4.57785458E-06	-5.508771951807
B( 3 )	8.10284722E-09	1.79035427E-09	4.525834547334
B( 4 )	-8.67948833E-13	2.20017839E-13	-3.9449020080102

B(0) = -.222286003448

STD. ERROR OF B(0) = .7722359604485



## TABLE OF RESIDUALS

X	Y	Y(CAL)	E(I)
0	0	-.222286003448	.222286003448
200	4	4.79876082419	-.79876082419
400	9	8.171833707944	.828166292056
800	11	11.29649966485	-.29649966485
1600	10.5	10.4505693126	.0494306874
3200	11.5	11.50635778708	-.00635778708
4000	12	11.99826470695	.00173529305

END OF PROGRAM

คำนวณหาสหสัมพันธ์ และสมการรีเกรซัน ของจำนวน Acentric  
chromosome (เฉลี่ย 10 ขำ)

## POLYNOMIAL REGRESSION ANALYSIS

PROJECT NAME: SAOWANEE'S JOB

RUN BY: SAMORN

DATE: 03/30/81

DATA FILE: DATA7 # VOLUMES = 1

NO. OF OBSERVATIONS = 6

ORDER OF POLYNOMIAL = 2

## INPUT DATA:

OBS. #	X	Y	W
1	0	0	1
2	200	.8	1

OBS. #	X	Y	W
3	400	2.4	1
4	800	3.3	1
5	1600	3.8	1
6	3200	3.8	1

## POLYNOMIAL REGRESSION ANALYSIS

PROJECT NAME: SAOWANEE'S JOB

RUN BY: SAMORN

DATE: 03/30/81

DATA FILE: DATA7 # VOLUMES = 1

NO. OF OBSERVATIONS = 6

ORDER OF POLYNOMIAL = 2

MEAN OF X AND Y:

1033.333333334 2.35

STD. DEV. OF X AND Y:

1202.774570178 1.614620698492

CORRELATION MATRIX:

1	.9657555276611	.7651807864628
.9657555276611	1	.5888214573241

COEFFICIENT OF MULTIPLE DETERMINATION = .9204409086773

CORRELATION COEFFICIENT = .9593961166678

ADJUSTED COEFFICIENT OF MULTIPLE DETERMINATION = .8674015144622

ADJUSTED CORRELATION COEFFICIENT = .9313439292034

S.S. ATTRIBUTABLE TO REGRESSION = 11.997972446

S.S. OF DEVIATION FROM REGRESSION = 1.03705275539

VARIANCE OF ESTIMATE = .3456842517967

STD. ERROR OF ESTIMATE = .5879491915095

ANALYSIS OF VARIANCE FOR THE POLYNOMIAL REGRESSION

SOURCE	D.F.	S.S.	M.S.	F
REGRESS.	2	11.9979472446	5.9989736233	17.35391066015
RESIDUAL	3	1.03705275539	.3456842517967	
TOTAL	5	13.034999999		

	REGRESSION COEFFICIENT	STD. ERROR	T-VALUE
B( 1 )	3.91904401E-03	8.42578873E-04	4.651248850622
B( 2 )	-8.95707325E-07	2.52038780E-07	-3.553847246074

B(0) = .336562500007

STD. ERROR OF B(0) = .4247398838187

TABLE OF RESIDUALS

X	Y	m	Y(CAL)	E(I)
0	0		.336562500007	-.336562500007
200	.8		1.084543010758	-.284543010758
400	2.4		1.760866935488	.639133064512
800	3.3		2.898545026884	.401454973116



X	Y	Y(CAL)	E(I)
1600	3.8	4.314022177417	-.514022177417
3200	3.8	3.705460349453	.094539650547

END OF PROGRAM

คำนวณหาสหสัมพันธ์ และสมการรีเกรซชัน ของจำนวนacentric chromosome  
(เฉลี่ย 4 ข้าง)

POLYNOMIAL REGRESSION ANALYSIS

PROJECT NAME: SAOWANEE'S JOB

RUN BY: SAMORN

DATE: 03/30/81

DATA FILE: DATA8 # VOLUMES = 1

NO. OF OBSERVATIONS = 7

ORDER OF POLYNOMIAL = 2

INPUT DATA:

OBS. #	X	Y	W
1	0	0	1
2	200	.75	1
3	400	2	1
4	800	3.5	1
5	1600	4	1
6	3200	3.5	1
7	4000	3.5	1

## POLYNOMIAL REGRESSION ANALYSIS

PROJECT NAME: SAOWANEE'S JOB

RUN BY: SAMORN

DATE: 03/30/81

DATA FILE: DATA8 # VOLUMES = 1

NO. OF OBSERVATIONS = 7

ORDER OF POLYNOMIAL = 2

MEAN OF X AND Y:

1457.142857142 2.464285714285

STD. DEV. OF X AND Y:

1569.349273698 1.570752018863

CORRELATION MATRIX:

1	.9735237120243	.696046752168
.9735237120243	1	.5280565009652

COEFFICIENT OF MULTIPLE DETERMINATION = .8752378751533

CORRELATION COEFFICIENT = .9355414876708

ADJUSTED COEFFICIENT OF MULTIPLE DETERMINATION = .8128568127299

ADJUSTED CORRELATION COEFFICIENT = .9015857212323

S.S. ATTRIBUTABLE TO REGRESSION = 12.95664640183

S.S. OF DEVIATION FROM REGRESSION = 1.84692502675

VARIANCE OF ESTIMATE = .4617312566875

STD. ERROR OF ESTIMATE = .6795080990595

## ANALYSIS OF VARIANCE FOR THE POLYNOMIAL REGRESSION

SOURCE	D.F.	S.S.	M.S.	F
REGRESS.	2	12.95664640183	6.478323200915	14.03050607271
RESIDUAL	4	1.84692502675	.4617312566875	
TOTAL	6	14.80357142858		

	REGRESSION COEFFICIENT	STD. ERROR	T-VALUE
B( 1 )	3.38146581E-03	7.73302971E-04	4.372756786312
B( 2 )	-6.82377059E-07	1.90954098E-07	-3.573513561078

$$B(0) = .42638638967$$

$$\text{STD. ERROR OF } B(0) = .464214097697$$

## TABLE OF RESIDUALS

X	Y	Y(CAL)	E(I)
0	0	.42638638967	-.42638638967
200	.75	1.075384470611	-.325384470611
400	2	1.669792386753	.330207613247
800	3.5	2.69483772464	.80516227536
1600	4	4.089846422825	-.089846422825
3200	3.5	4.259535908835	-.759535908835
4000	3.5	3.034216696662	.465783303338

END OF PROGRAM



ประวัติ

นาย ศุภฤกษ์ รุ่งเจ็ดฟ้า เกิดวันที่ 23 กันยายน พ.ศ. 2499 ที่จังหวัด นครสวรรค์ สำเร็จการศึกษาระดับมัธยมศึกษา สาขาชีววิทยา จากมหาวิทยาลัย รามคำแหง ปีการศึกษา 2521 เข้าศึกษาในระดับปริญญาโท สาขา ภาควิชา พฤกษศาสตร์ คณะมัณฑนศิลป์ จุฬาลงกรณ์มหาวิทยาลัย ในปีการศึกษา 2522 และได้รับทุนอุดหนุนการวิจัยจากมัณฑนศิลป์ ในปีการศึกษา 2523.

