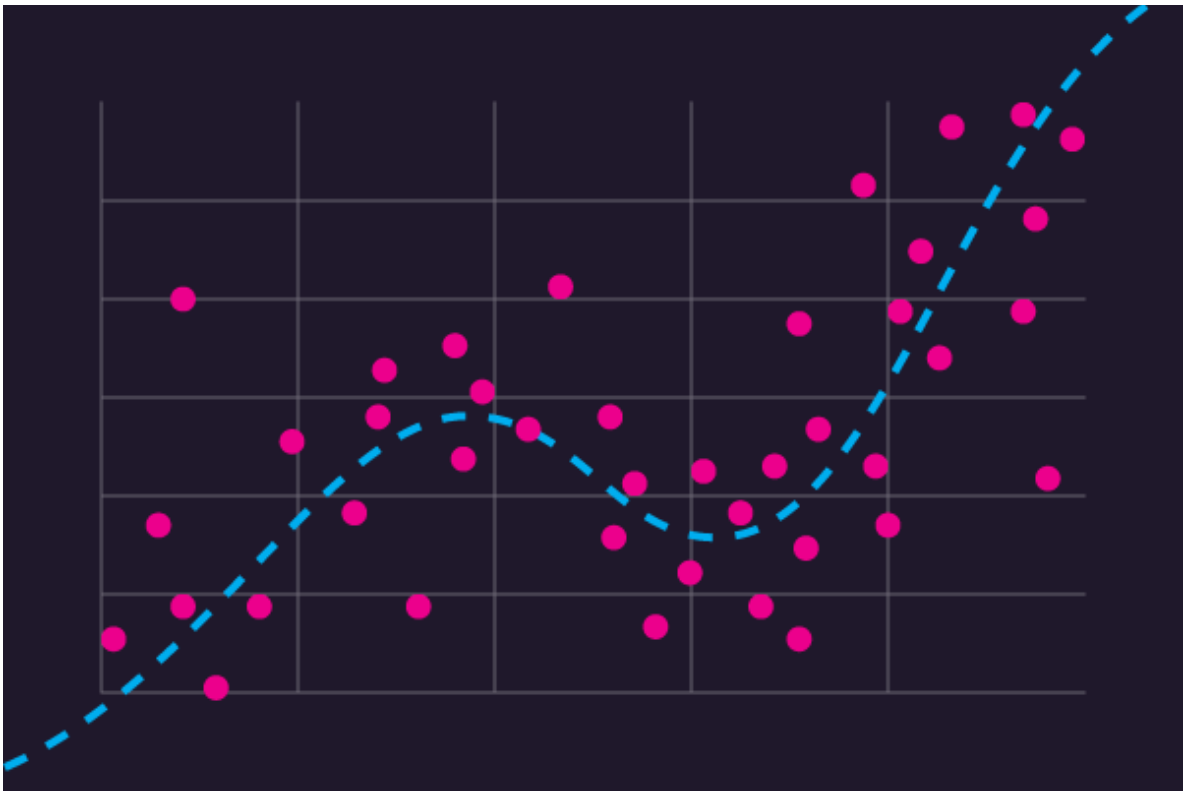
Universidad
Católica del Norte

MODELACIÓN Y SIMULACIÓN AVANZADA

TAREA 2 v2



Estudiante:

Marcelo Saavedra Alcoba

PROFESOR: PhD. Ranjit Das

II/2022

a) Multiple Regression with the given data

For this, the values of X1=logR , X2=R and Y=PGA are taken.

The first step is to solve the problem using Excel Data Analysis, the results are displayed below:

	A	B	C	D	E	F	G	H	I
1	Resumen								
2									
3	*Estadísticas de la regresión*								
4	Coeficiente d	0,55791101							
5	Coeficiente d	0,31126469							
6	R^2 ajustado	0,31087292							
7	Error típico	0,10266913							
8	Observacione	3519							
9									
10	ANÁLISIS DE VARIANZA								
11		*Grados de libert*	*na de cuadrad*	*dio de los cuac*	*F*	*'alor crítico de F*			
12	Regresión	2	16,7496669	8,37483347	794,504543	1,977E-285			
13	Residuos	3516	37,0619838	0,01054095					
14	Total	3518	53,8116507						
15									
16		*Coeficientes*	*Error típico*	*Estadístico t*	*Probabilidad*	*Inferior 95%*	*Superior 95%*	*Inferior 95,0%*	*Superior 95,0%*
17	**Intercepción**	**0,469038**	0,01219247	38,4694734	1,526E-270	0,44513294	0,49294301	0,44513294	0,49294301
18	**Variable X 1**	**- 0,235612**	0,0090904	-25,9188007	1,074E-135	-0,2534353	-0,21778931	-0,2534353	-0,21778931
19	**Variable X 2**	**0,000443**	6,3538E-05	6,97109677	3,7394E-12	0,00031836	0,00056751	0,00031836	0,00056751
20									

As can be seen in the Data Analysis results, the values for the multiple regression of this problem are:

$$\boldsymbol{a = 0.469038}$$

$$\boldsymbol{b_1 = -0.235612}$$

$$\boldsymbol{b_2 = 0.000443}$$

The operation is carried out using multiple regression formulas to reach the previous results in excel, the results are shown below:

	A	B	C	D	E	F	G	H	I	J	K	L	M
1	logR	R	PGA (g)		x1*y	x2*y	x1*x2	x1^2	x2^2				YP
2	2,746346	557,63	0,00093		0,002553	0,518345	1531,445	7,542417068	310951,2	n	3519		0,068957
3	2,417555	261,55	0,001159		0,002803	0,303261	632,3114	5,844570845	68408,4				0,015281
4	1,64611	44,27	0,001993		0,00328	0,088213	72,87327	2,709676558	1959,833	SUM x1	6235,60612		0,100803
5	2,401952	252,32	0,002127		0,005109	0,536735	606,0604	5,769371854	63665,38	SUM x2	276905,95		0,014869
6	2,171492	148,42	0,003221		0,006994	0,478008	322,2929	4,715379362	22028,5	SUM y	304,009607		0,023148
7	2,417555	261,55	0,003335		0,008062	0,872202	632,3114	5,844570845	68408,4	SUM x1*y	-89,7081353		0,015281
8	2,441852	276,6	0,003693		0,009019	1,021618	675,4163	5,962642048	76507,56	SUM x2*y	-9903,7174		0,016223
9	2,425012	266,08	0,003798		0,009211	1,010688	645,2473	5,880684325	70798,57	SUM x1*x2	61105,243		0,015531
10	2,066736	116,61	0,003939		0,008142	0,459377	241,0021	4,271396848	13597,89	SUM x1^2	495,617598		0,03374
11	2,038421	109,25	0,003987		0,008128	0,435613	222,6975	4,15516199	11935,56	SUM x2^2	10144738,7		0,037151
12	1,95347	89,84	0,004397		0,00859	0,395041	175,4997	3,816044038	8071,226				0,048569
13	2,349549	223,64	0,004407		0,010354	0,985503	525,4532	5,520382776	50014,85	b1	-0,23561231		0,014513
14	1,773274	59,33	0,004443		0,007879	0,2636	105,2084	3,144501914	3520,049	b2	0,00044293		0,077512
15	2,435765	272,75	0,004497		0,010955	1,226676	664,3548	5,932949962	74392,56	a	0,46903798		0,015952
16	2,100681	126,09	0,004499		0,009451	0,567297	264,8748	4,412859171	15898,69				0,029941
17	1,870813	74,27	0,004564		0,008539	0,338993	138,9453	3,499942867	5516,033				0,061148
18	2,438289	274,34	0,004606		0,011231	1,263584	668,9202	5,945253902	75262,44				0,016061
19	2,210853	162,5	0,00463		0,010236	0,752377	359,2637	4,887872603	26406,25				0,02011
20	2,185882	153,42	0,004647		0,010158	0,712981	335,358	4,778080024	23537,7				0,021972
21	2,070518	117,63	0,004661		0,009652	0,54832	243,555	4,28704519	13836,82				0,033301
22	2,078094	119,7	0,004666		0,009697	0,558541	248,7479	4,318475298	14328,09				0,032432
23	2,448706	281	0,004673		0,011443	1,313108	688,0865	5,996162641	78961				0,016557
24	1,99743	99,41	0,004688		0,009364	0,466013	198,5645	3,9897269	9882,348				0,042451
25	2,050728	112,39	0,004705		0,009649	0,528837	230,4813	4,205483981	12631,51				0,035642
26	1,785543	61,03	0,004718		0,008424	0,287925	108,9717	3,188165126	3724,661				0,075374
27	2,209542	162,01	0,00472		0,010429	0,764702	357,9679	4,882075063	26247,24				0,020202
28	1,976121	94,65	0,004781		0,009447	0,452495	187,0398	3,905052698	8958,623				0,045363
29	1,872972	74,64	0,004811		0,009012	0,359126	139,7086	3,50902273	5571,13				0,060803

Fig 1. Multiple Regression in Excel

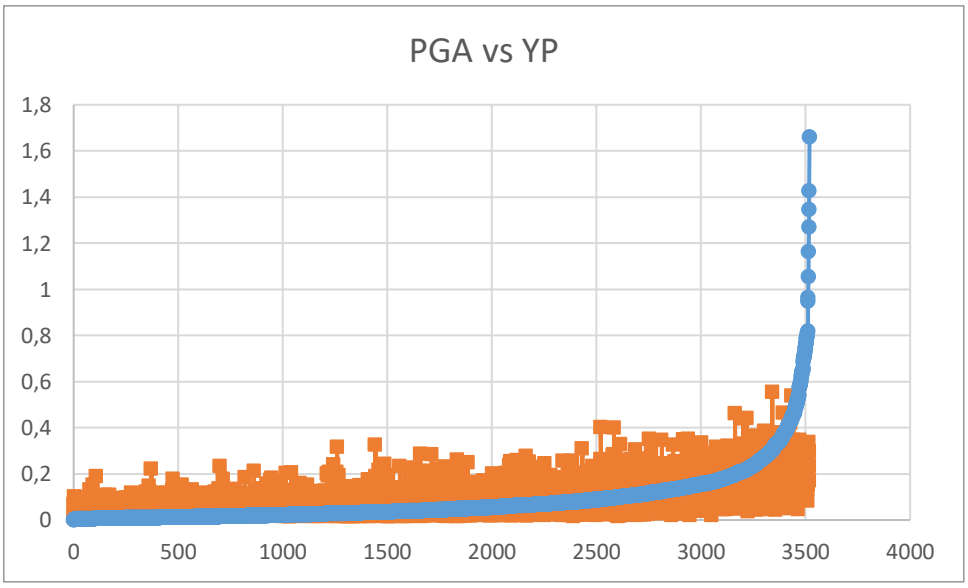


Fig 2. Graph of Multiple Regression in Excel

The problem was also solved in Matlab:

```
clc; clear all; close all
T = open('Test 2_Multiple Reg.xlsx');
%load('valModel.mat');
y=T.data(:,1);
x1=T.data(:,2);
x2=T.data(:,3);
n=size(x1);
sumx1=sum(x1);
sumx2=sum(x2);
sumy=sum(y);
ym=mean(y);

x1y=x1.*y
sumx1y=sum(x1y)
Sx1y=sumx1y-sumx1*sumy/n(1)

x2y=x2.*y
sumx2y=sum(x2y)
Sx2y=sumx2y-sumx2*sumy/n(1)

x1x2=x1.*x2
sumx1x2=sum(x1x2)
Sx1x2=sumx1x2-sumx1*sumx2/n(1)

x122=x1.^2
sumx122=sum(x122)
Sx1_2=sumx122-sumx1^2/n(1)


x222=x2.^2
sumx222=sum(x222)
Sx2_2=sumx222-sumx2^2/n(1)

b1=(Sx1y*Sx2_2-Sx2y*Sx1x2)/(Sx1_2*Sx2_2-Sx1x2^2)
b2=(Sx2y*Sx1_2-Sx1y*Sx1x2)/(Sx1_2*Sx2_2-Sx1x2^2)
a=(sumy-b1*sumx1-b2*sumx2)/(n(1))

yp=a+b1.*x1+b2.*x2;

[a b1 b2]

scatter3(x1,x2,y,'filled')
hold on
x1fit = min(x1):0.1:max(x1);
x2fit = min(x2):10:max(x2);
[size(x1fit) size(x2fit)]
[X1FIT,X2FIT] = meshgrid(x1fit,x2fit);
YFIT = a + b1*X1FIT + b2*X2FIT ;
mesh(X1FIT,X2FIT,YFIT)
xlabel('logR')
ylabel('R')
zlabel('PGA(g)')
view(50,10)
hold off
```

The results in Matlab match the previous data:

```
>> [a b1 b2]

ans =

         0.469037975696471        -0.235612308095416       0.000442932053122101
```

The 3d graph of the problem is displayed below:

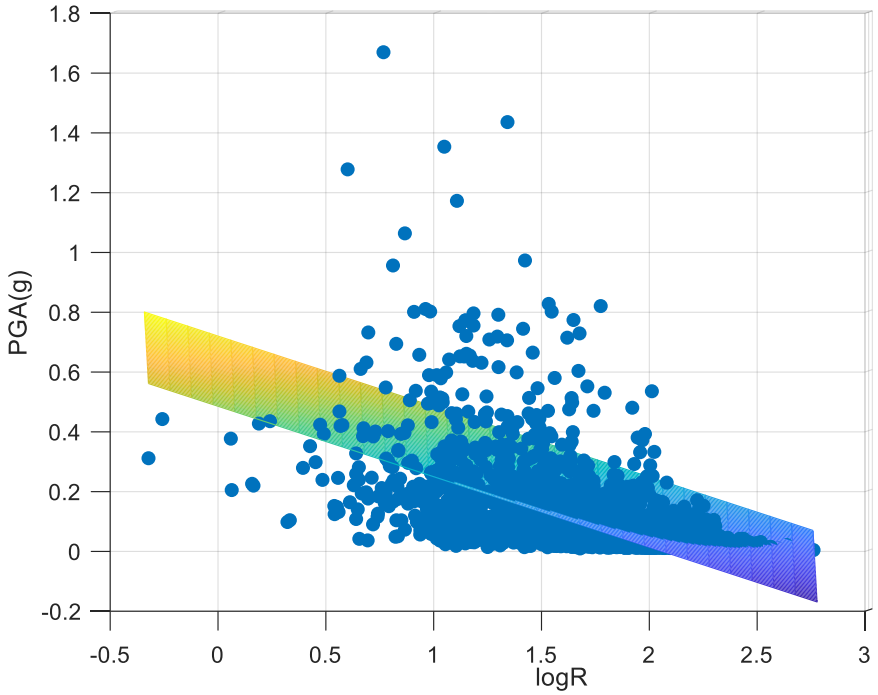


Fig 3. Graph of PGA vs logR in matlab

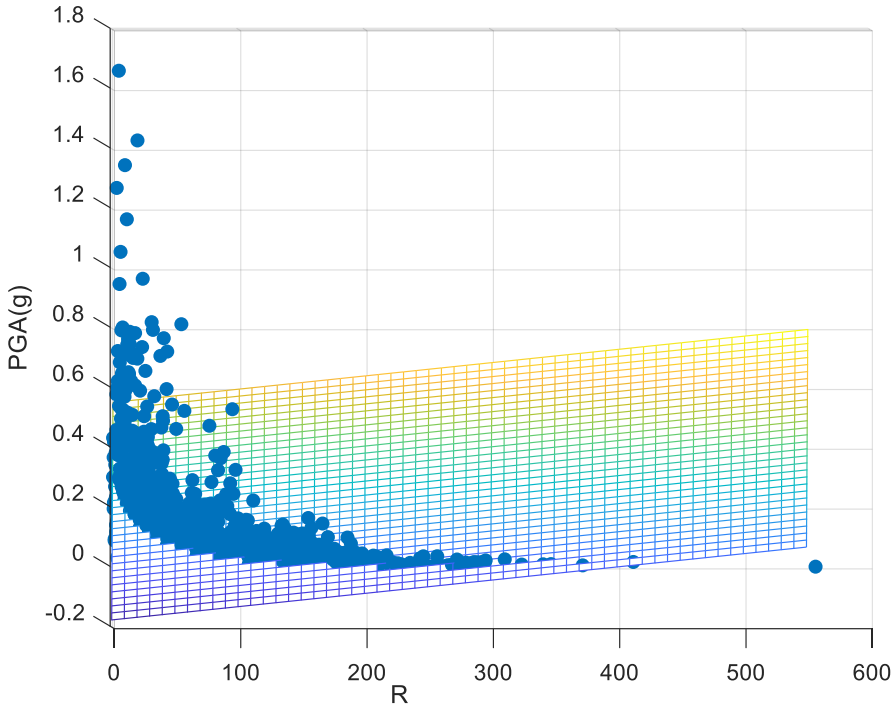


Fig 4. Graph of PGA vs R in matlab

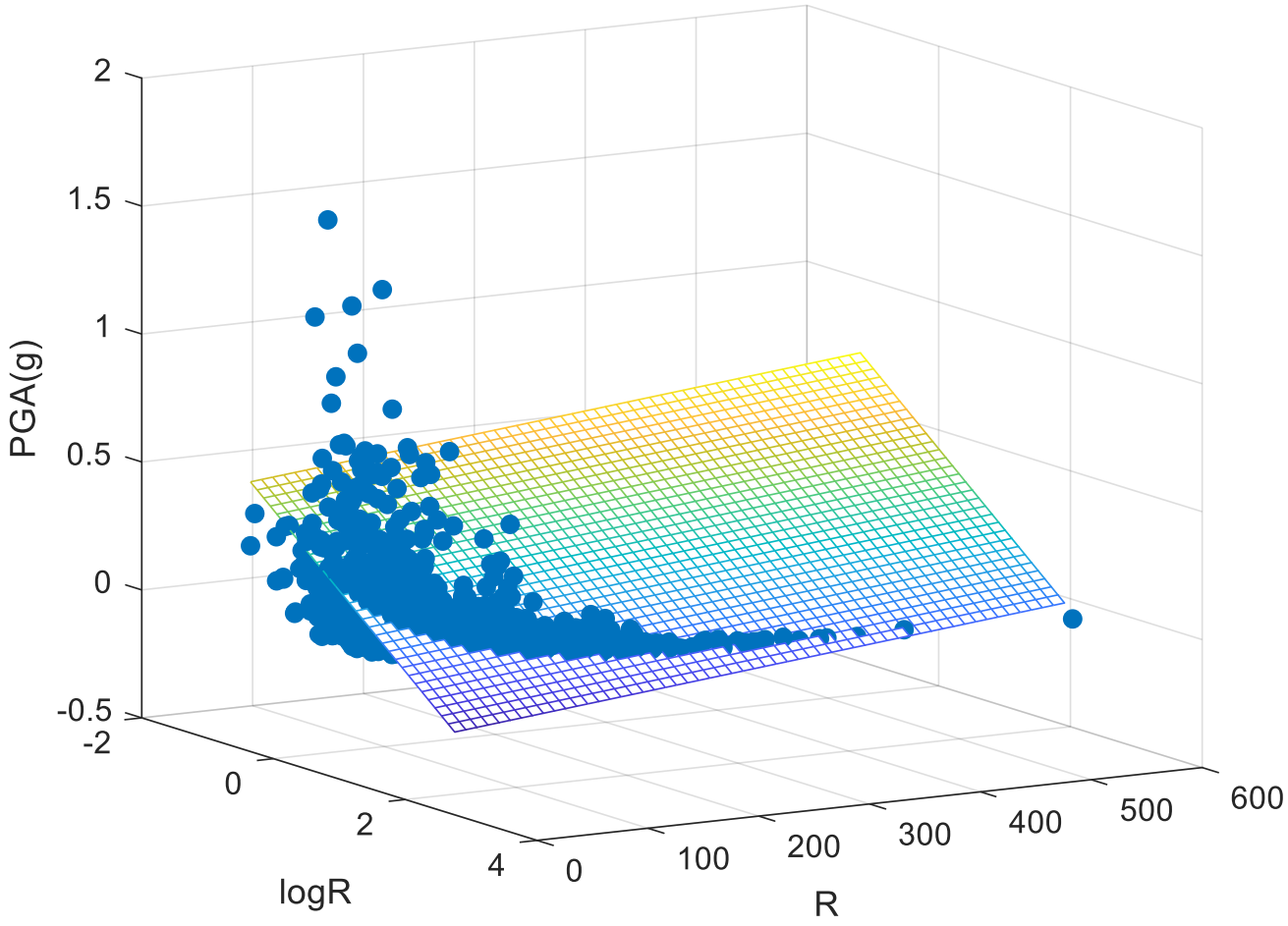


Fig 5. Isometric view of Multiple Regression in Matlab