```
options nonumber orientation=landscape linesize=130 pagesize=50 nodate;
options nofmterr validvarname=v7;
OPTIONS FORMCHAR="|----|+|---+=|-/\<>*";
options formdlim='-';

title1 'Exercise - Valve Failures';
data valves;
input numfail month;
monthsq=month*month;

label numfail="# Failures"
month="time since install"
;

datalines;
5 18
3 15
0 11
1 14
4 23
0 10
0 5
1 8
0 7
0 12
0 3
1 7
0 2
7 30
0 9
;
run;
proc print data=valves;
run;
ods pdf file="Poissonshow.pdf";
proc genmod data=valves;
model numfail=month/dist=poisson link=log predicted residual cl;
output out=dataout1 predicted=failurehat;
run;

proc gplot data=dataout1;
plot numfail*month='O' failurehat*month/overlay;
run;

proc genmod data=valves;
model numfail=month monthsq/dist=poisson link=log type1 type3 cl;
output out=dataout2 predicted=failurehat;
run;

proc gplot data=dataout2;
plot numfail*month='O' failurehat*month/overlay;
run;

ods graphics off;
quit;
run;

ods pdf close;
run;
```

Exercise - Valve Failures

The GENMOD Procedure

Model Information		
Data Set	WORK.VALVES	
Distribution	Poisson	
Link Function	Log	
Dependent Variable	numfail	# Failures

Number of Observations Read	15
Number of Observations Used	15

Parameter Information	
Parameter	**Effect**
Prm1	Intercept
Prm2	month

Criteria For Assessing Goodness Of Fit			
Criterion	**DF**	**Value**	**Value/DF**
Deviance	13	14.9350	1.1488
Scaled Deviance	13	14.9350	1.1488
Pearson Chi-Square	13	13.3312	1.0255
Scaled Pearson X2	13	13.3312	1.0255
Log Likelihood		1.0421	
Full Log Likelihood		-17.2404	
AIC (smaller is better)		38.4807	
AICC (smaller is better)		39.4807	
BIC (smaller is better)		39.8968	

Algorithm converged.

Exercise - Valve Failures

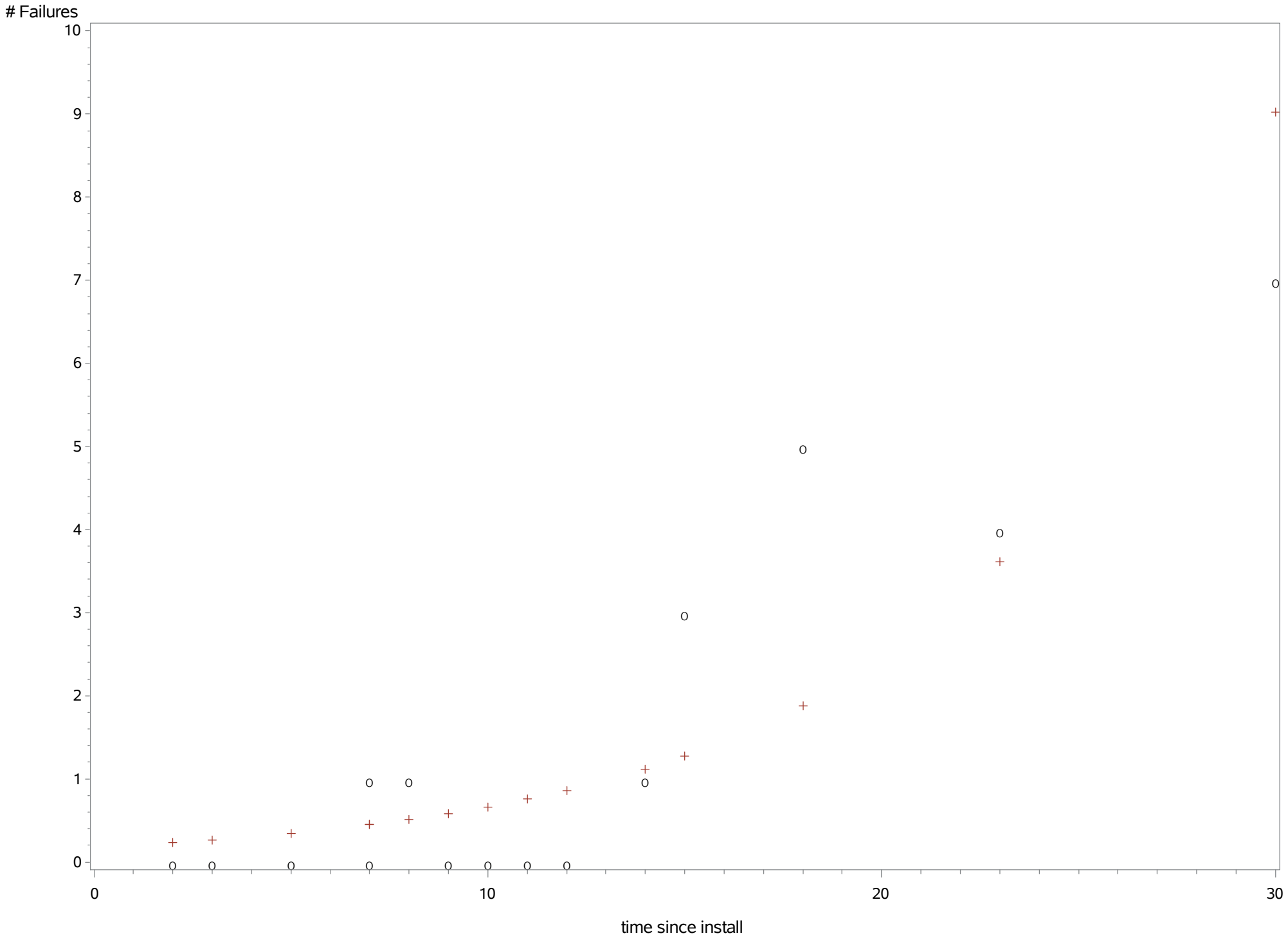
The GENMOD Procedure

Analysis Of Maximum Likelihood Parameter Estimates							
Parameter	DF	Estimate	Standard Error	Wald 95% Confidence Limits		Wald Chi-Square	Pr > ChiSq
Intercept	1	-1.7200	0.5577	-2.8130	-0.6269	9.51	0.0020
month	1	0.1306	0.0243	0.0830	0.1783	28.83	<.0001
Scale	0	1.0000	0.0000	1.0000	1.0000		

Note: The scale parameter was held fixed.

Observation Statistics													
Observation	numfail	Predicted Value	Linear Predictor	Standard Error of the Linear Predictor	HessWgt	Lower	Upper	Raw Residual	Pearson Residual	Deviance Residual	Std Deviance Residual	Std Pearson Residual	Likelihood Residual
1	5	1.8807605	0.6316762	0.2268202	1.8807605	1.2057682	2.9336153	3.1192395	2.2744792	1.8812597	1.9794622	2.393208	2.0231972
2	3	1.2709165	0.2397383	0.2609132	1.2709165	0.7621269	2.1193696	1.7290835	1.5337602	1.3019513	1.3622125	1.6047508	1.3848761
3	0	0.7536361	-0.282846	0.3268352	0.7536361	0.3971541	1.4300931	-0.753636	-0.868122	-1.22771	-1.280327	-0.905328	-1.254295
4	1	1.1152653	0.1090923	0.275656	1.1152653	0.6497396	1.9143309	-0.115265	-0.109146	-0.111112	-0.116143	-0.114088	-0.11597
5	4	3.6143287	1.2849061	0.2177416	3.6143287	2.3587705	5.5382124	0.3856713	0.2028633	0.199407	0.2190573	0.2228541	0.2197125
6	0	0.661337	-0.413492	0.3456405	0.661337	0.3359024	1.3020648	-0.661337	-0.813226	-1.150076	-1.198391	-0.84739	-1.174482
7	0	0.3441349	-1.066722	0.4477235	0.3441349	0.1430954	0.8276213	-0.344135	-0.58663	-0.82962	-0.859807	-0.607975	-0.844848
8	1	0.5092666	-0.674784	0.385112	0.5092666	0.2394072	1.083311	0.4907334	0.6876588	0.6067128	0.6310108	0.7151985	0.6377576
9	0	0.4468959	-0.80543	0.4055972	0.4468959	0.2018187	0.9895809	-0.446896	-0.668503	-0.945406	-0.9822	-0.69452	-0.963978
10	0	0.8588168	-0.1522	0.3088026	0.8588168	0.4688644	1.5730906	-0.858817	-0.926724	-1.310585	-1.36779	-0.967173	-1.339493
11	0	0.2650032	-1.328014	0.4910592	0.2650032	0.1012187	0.6938114	-0.265003	-0.514785	-0.728015	-0.752454	-0.532065	-0.740336
12	1	0.4468959	-0.80543	0.4055972	0.4468959	0.2018187	0.9895809	0.5531041	0.8273775	0.7103879	0.7380354	0.859578	0.7476442
13	0	0.2325478	-1.45866	0.5130852	0.2325478	0.0850694	0.6356984	-0.232548	-0.482232	-0.681979	-0.703865	-0.497707	-0.693008
14	7	9.019853	2.199428	0.302464	9.019853	4.985878	16.317637	-2.019853	-0.672543	-0.700325	-1.674942	-1.608496	-1.620309
15	0	0.580342	-0.544138	0.3650991	0.580342	0.2837338	1.1870171	-0.580342	-0.761802	-1.07735	-1.121606	-0.793095	-1.099701

Exercise - Valve Failures



Exercise - Valve Failures

The GENMOD Procedure

Model Information		
Data Set	WORK.VALVES	
Distribution	Poisson	
Link Function	Log	
Dependent Variable	numfail	# Failures

Number of Observations Read	15
Number of Observations Used	15

Parameter Information	
Parameter	**Effect**
Prm1	Intercept
Prm2	month
Prm3	monthsq

Criteria For Assessing Goodness Of Fit			
Criterion	**DF**	**Value**	**Value/DF**
Deviance	12	10.7694	0.8975
Scaled Deviance	12	10.7694	0.8975
Pearson Chi-Square	12	10.6242	0.8854
Scaled Pearson X2	12	10.6242	0.8854
Log Likelihood		3.1249	
Full Log Likelihood		-15.1576	
AIC (smaller is better)		36.3152	
AICC (smaller is better)		38.4970	
BIC (smaller is better)		38.4394	

Exercise - Valve Failures

The GENMOD Procedure

Algorithm converged.

Analysis Of Maximum Likelihood Parameter Estimates							
Parameter	DF	Estimate	Standard Error	Wald 95% Confidence Limits		Wald Chi-Square	Pr > ChiSq
Intercept	1	-4.4361	1.7059	-7.7795	-1.0927	6.76	0.0093
month	1	0.4587	0.1796	0.1067	0.8106	6.52	0.0106
monthsq	1	-0.0083	0.0043	-0.0168	0.0003	3.61	0.0576
Scale	0	1.0000	0.0000	1.0000	1.0000		

Note: The scale parameter was held fixed.

LR Statistics For Type 1 Analysis				
Source	Deviance	DF	Chi-Square	Pr > ChiSq
Intercept	44.1675			
month	14.9350	1	29.23	<.0001
monthsq	10.7694	1	4.17	0.0413

LR Statistics For Type 3 Analysis			
Source	DF	Chi-Square	Pr > ChiSq
month	1	8.60	0.0034
monthsq	1	4.17	0.0413

Observation Statistics		
Observation	Lower	Upper
1	1.7063762	5.7729707
2	0.9982076	3.2307237
3	0.3102543	1.4768411
4	0.7927263	2.6245289

Exercise - Valve Failures

The GENMOD Procedure

Observation Statistics		
Observation	**Lower**	**Upper**
5	3.1951734	10.23968
6	0.2071765	1.2501875
7	0.0147589	0.6171203
8	0.0811041	0.9241843
9	0.0477429	0.8037372
10	0.4437778	1.7671544
11	0.0039433	0.4803721
12	0.0477429	0.8037372
13	0.0019327	0.4253547
14	3.1525425	13.910924
15	0.1323739	1.0701139

Exercise - Valve Failures