Question 1

Q1 1.

Death Event 0

```
    creatinine_phosphokinase    serum_creatinine    serum_sodium    platelets
DEATH_EVENT
14  80  1.0 138 427000.0    0
20  52  1.3 137 276000.0    0
23  63  0.8 135 368000.0    0
33  159 1.2 138 302000.0    0
38  2656    2.3 137 305000.0    0
... ... ... ... ... ...
294 61  1.1 143 155000.0    0
295 1820    1.2 139 270000.0    0
296 2060    0.8 138 742000.0    0
297 2413    1.4 140 140000.0    0
298 196 1.6 136 395000.0    0
203 rows × 5 columns
```

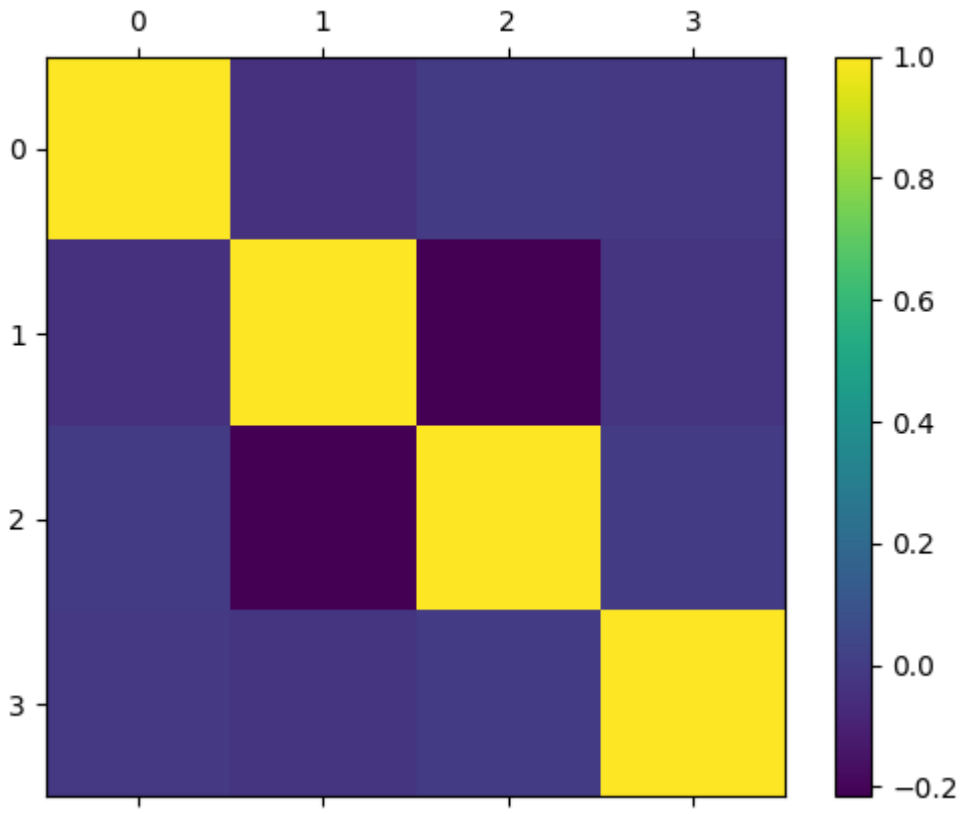
Death Event 1

```
    creatinine_phosphokinase    serum_creatinine    serum_sodium    platelets
DEATH_EVENT
0   582 1.90    130 265000.00   1
1   7861    1.10    136 263358.03   1
2   146 1.30    129 162000.00   1
3   111 1.90    137 210000.00   1
4   160 2.70    116 327000.00   1
... ... ... ... ... ...
220 582 1.83    134 263358.03   1
230 166 1.70    127 62000.00    1
246 2017    1.10    138 314000.00   1
262 258 1.40    129 198000.00   1
266 1199    1.83    134 263358.03   1
96 rows × 5 columns
```

Q1 2.

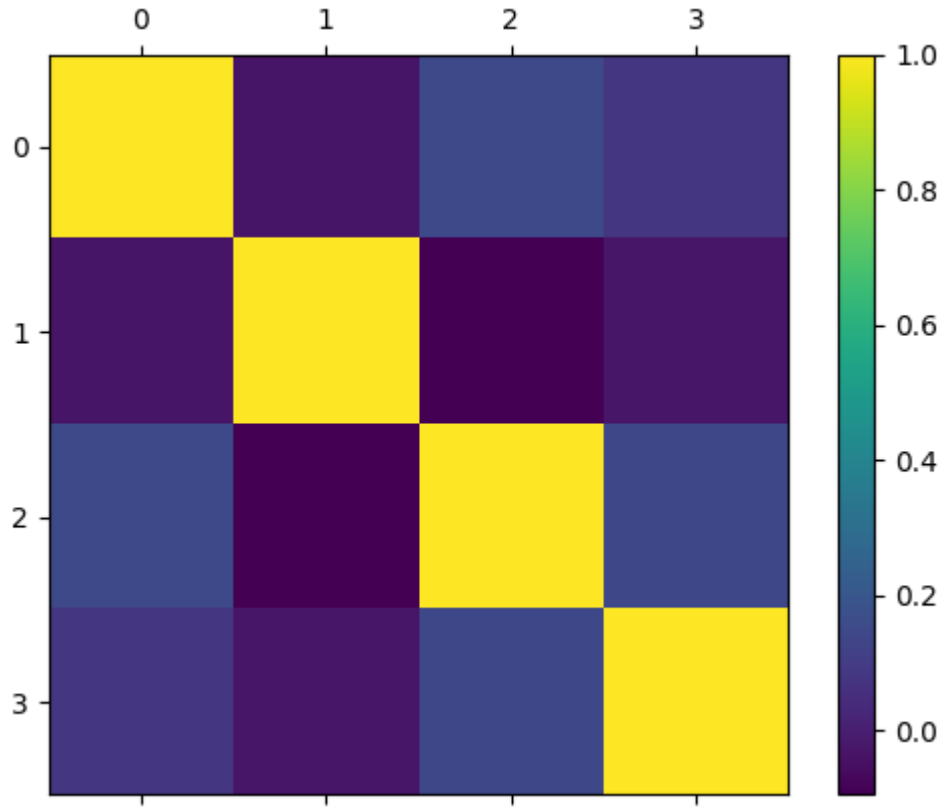
Death Event 0

```
    creatinine_phosphokinase    serum_creatinine    serum_sodium    platelets
creatinine_phosphokinase    1.000000    -0.043110   -0.002474   -0.012940
serum_creatinine    -0.043110   1.000000    -0.215651   -0.031217
serum_sodium    -0.002474   -0.215651   1.000000    0.001807
platelets   -0.012940   -0.031217   0.001807    1.000000
```



Death Event 1

```
    creatinine_phosphokinase    serum_creatinine    serum_sodium    platelets
creatinine_phosphokinase    1.000000    -0.033407   0.148823    0.078808
serum_creatinine    -0.033407   1.000000    -0.094011   -0.029384
serum_sodium    0.148823    -0.094011   1.000000    0.141284
platelets   0.078808    -0.029384   0.141284    1.000000
```



Q1 3.

a)

serum_sodium and creatinine_phosphokinase have the highest correlation for surviving patients

b)

serum_sodium and serum_creatinine have the lowest correlation for surviving patients

c)

serum_sodium and creatinine_phosphokinase have the highest correlation for deceased patients

d)

serum_sodium and serum_creatinine have the lowest correlation for deceased patients

Question 2

Q2 1.

Group - 1 ['creatinine_phosphokinase', 'platelets']

DEATH_EVENT 0 Linear Regression y = ax + b
a= -12.056252013903174 b= 277836.3748904729
SSE = 86268284695140.94

DEATH_EVENT 0 quadratic y = ax2 + bx + c
a= -19.71500724390465 b= 0.003473895167648312 c= 279623.1091852791
SSE = 85858520623116.44\

DEATH_EVENT 0 cubic spline y = ax3 + bx2 + cx + d
a= 43.685770256837266 b= -0.0756564247701897 c= 2.1757802860164488e-05 d= 271414.33817792987
SSE = 308981266636131.7

DEATH_EVENT 0 GLM - generalized linear model y = a log x + b
a= -2526.0275790125534 b= 286230.20174363826
SSE = 85404313518196.0

DEATH_EVENT 0 GLM - generalized linear model log y = a log x + b
a= -0.022620571643850697 b= 12.573733849525707
SSE = 85129802604718.23

DEATH_EVENT 1 Linear Regression y = ax + b
a= 4.532841029553679 b= 260958.30654938702
SSE = 21673129833826.414

DEATH_EVENT 1 quadratic y = ax2 + bx + c
a= -43.6971646754312 b= 0.007292255417581923 c= 278391.51736943494
SSE = 22908175840926.992

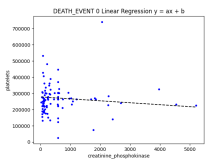
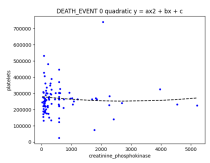
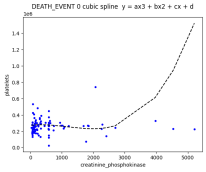
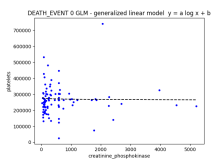
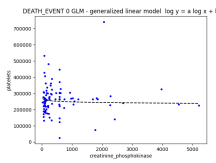
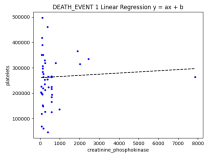
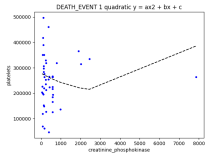
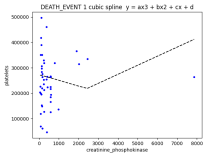
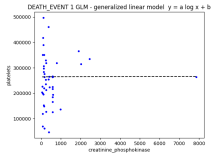
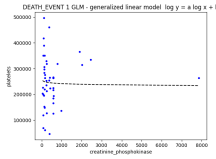
DEATH_EVENT 1 cubic spline y = ax3 + bx2 + cx + d
a= -17.969919437517238 b= -0.004255613315961509 c= 1.1203291195357318e-06 d= 271770.8207854917
SSE = 23110455826344.88

DEATH_EVENT 1 GLM - generalized linear model y = a log x + b
a= 252.91767830090967 b= 262930.6007441235
SSE = 21662980075280.24

DEATH_EVENT 1 GLM - generalized linear model log y = a log x + b
a= -0.015723349980061384 b= 12.503826073216116
SSE = 21120845867702.18

```
                 Model  SSE (death event=0)  SSE (death event=1)
             y = ax + b         8.626828e+13         2.167313e+13
       y = ax2 + bx + c         8.585852e+13         2.290818e+13
   y = ax3 + bx2 + cx + d         3.089813e+14         2.311046e+13
       y = a log x + b         8.540431e+13         2.166298e+13
   log y = a log x + b         8.512980e+13         2.112085e+13
```

Death Event	y = ax + b	y = ax2 + bx + c	y = ax3 + bx2 + cx + d	y = a log x + b	log y = a log x + b

Death Event	y = ax + b	y = ax2 + bx + c	y = ax3 + bx2 + cx + d	y = a log x + b	log y = a log x + b
Death Event 0					
Death Event 1					

Group - 2 ['platelets', 'serum_sodium']

DEATH_EVENT 0 Linear Regression y = ax + b
a= -8.176450693049772e-07 b= 137.22249780439034
SSE = 182761.28169131547

DEATH_EVENT 0 quadratic y = ax2 + bx + c
a= -2.0824890780328707e-05 b= 2.6831863871160218e-11 c= 140.3902619170264
SSE = 186733.4692964463

DEATH_EVENT 0 cubic spline y = ax3 + bx2 + cx + d
a= -2.742426774847624e-05 b= 4.5332811651327624e-11 c= -1.415859377657581e-17 d= 141.0572307234887
SSE = 187456.0116006601

DEATH_EVENT 0 GLM - generalized linear model y = a log x + b
a= -0.7871790911372236 b= 146.79831689853538
SSE = 183492.54232138384

DEATH_EVENT 0 GLM - generalized linear model log y = a log x + b
a= -0.005774794258581867 b= 4.991483291633895
SSE = 183964.45616100216

DEATH_EVENT 1 Linear Regression y = ax + b
a= 9.19144532213112e-06 b= 132.52819367170073
SSE = 41335.78932234564

DEATH_EVENT 1 quadratic y = ax2 + bx + c
a= 1.63688307475912e-05 b= -1.1456412576314803e-11 c= 131.54523739449937
SSE = 41971.3667369804

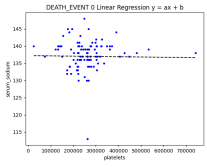
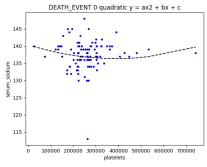
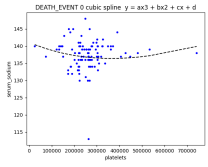
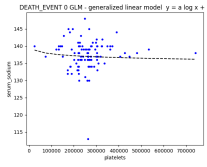
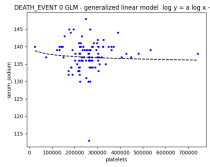
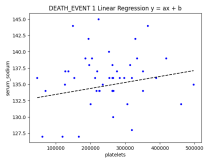
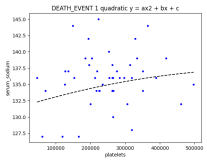
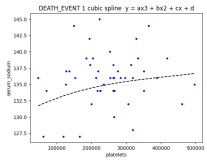
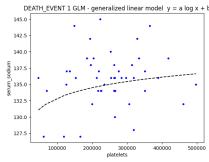
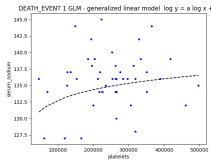
DEATH_EVENT 1 cubic spline y = ax3 + bx2 + cx + d
a= 2.9208355515999705e-05 b= -5.484666969957573e-11 c= 4.269337970077253e-17 d= 130.44785014935147
SSE = 42334.60288625662

DEATH_EVENT 1 GLM - generalized linear model y = a log x + b
a= 2.3553836859707302 b= 105.72093798887572

SSE = 42710.77765614027

DEATH_EVENT 1 GLM - generalized linear model log y = a log x + b
a= 0.017606934592944663 b= 4.685483882556029
SSE = 43330.57283552625

Model	SSE (death event=0)	SSE (death event=1)
y = ax + b	182761.281691	41335.789322
y = ax2 + bx + c	186733.469296	41971.366737
y = ax3 + bx2 + cx + d	187456.011601	42334.602886
y = a log x + b	183492.542321	42710.777656
log y = a log x + b	183964.456161	43330.572836

Death Event	y = ax + b	y = ax2 + bx + c	y = ax3 + bx2 + cx + d	y = a log x + b	log y = a log x + b
Death Event 0					
Death Event 1					

Group - 3 ['serum_sodium', 'serum_creatinine']

DEATH_EVENT 0 Linear Regression y = ax + b
a= -0.040189873417721504 b= 6.75007206416844
SSE = 3874.059248590759

DEATH_EVENT 0 quadratic y = ax2 + bx + c
a= -1.9537167599528058 b= 0.007026849999361861 c= 136.91737539928297
SSE = 6039.196371122711

DEATH_EVENT 0 cubic spline y = ax3 + bx2 + cx + d
a= 62.847579886456984 b= -0.47163474320788473 c= 0.001177436779252583 d= -2784.5126340910338
SSE = 10011.98447879598

DEATH_EVENT 0 GLM - generalized linear model y = a log x + b
a= -5.590372166982144 b= 28.746466817806457
SSE = 3901.9030942929285

DEATH_EVENT 0 GLM - generalized linear model log y = a log x + b
a= -3.2701487931261357 b= 16.202059380822302
SSE = 3660.488593572101

DEATH_EVENT 1 Linear Regression y = ax + b
a= -0.029067323394616228 b= 6.076835853131748
SSE = 1711.028583208675

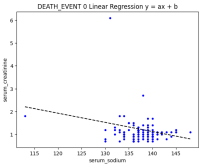
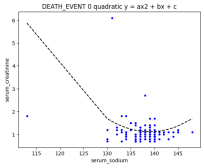
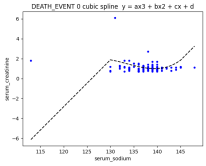
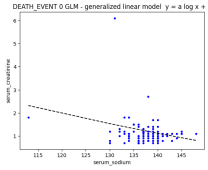
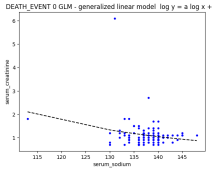
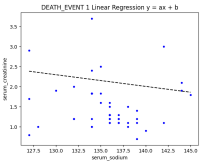
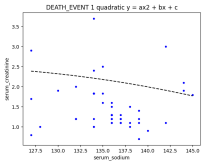
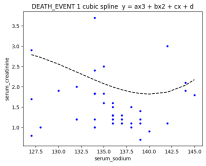
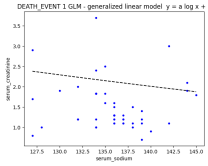
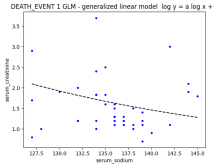
DEATH_EVENT 1 quadratic y = ax2 + bx + c
a= 0.1914993822214988 b= -0.0008299168744180171 c= -8.547227977225925
SSE = 1752.2997894139824

DEATH_EVENT 1 cubic spline y = ax3 + bx2 + cx + d
a= 27.052205391391944 b= -0.20549910060424093 c= 0.0005184434287653916 d= -1180.3158700827057
SSE = 1749.0841068373513

DEATH_EVENT 1 GLM - generalized linear model y = a log x + b
a= -3.7992155279965263 b= 20.78545904779382
SSE = 1706.019567943716

DEATH_EVENT 1 GLM - generalized linear model log y = a log x + b
a= -3.710591082424667 b= 18.714685292251932
SSE = 933.8600744666578

Model	SSE (death event=0)	SSE (death event=1)
y = ax + b	3874.059249	1711.028583
y = ax2 + bx + c	6039.196371	1752.299789
y = ax3 + bx2 + cx + d	10011.984479	1749.084107
y = a log x + b	3901.903094	1706.019568
log y = a log x + b	3660.488594	933.860074

Death Event	**y = ax + b**	**y = ax2 + bx + c**	**y = ax3 + bx2 + cx + d**	**y = a log x + b**	**log y = a log x + b**
Death Event 0					
Death Event 1					

Group - 4 ['platelets', 'serum_creatinine']

DEATH_EVENT 0 Linear Regression y = ax + b
a= -2.765441621615004e-07 b= 1.319312680506541
SSE = 3635.209589074442

DEATH_EVENT 0 quadratic y = ax2 + bx + c
a= -1.74246364726518e-06 b= 1.965955366295674e-12 c= 1.551412950778464
SSE = 3659.124039769493

DEATH_EVENT 0 cubic spline y = ax3 + bx2 + cx + d
a= -5.5555141451919355e-06 b= 1.265560811754054e-11 c= -8.180686343941246e-18 d= 1.93678050138503
SSE = 3700.4638589206497

DEATH_EVENT 0 GLM - generalized linear model y = a log x + b
a= -0.15575876590201154 b= 3.1828478788761005
SSE = 3673.0758917302837

DEATH_EVENT 0 GLM - generalized linear model log y = a log x + b
a= -0.09861413602616599 b= 1.3417156439004114
SSE = 3497.7393704806514

DEATH_EVENT 1 Linear Regression y = ax + b
a= -1.2766737633271879e-06 b= 2.4914999754249187
SSE = 1844.4231072837501

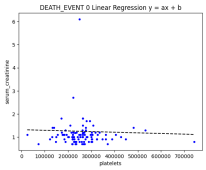
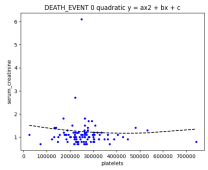
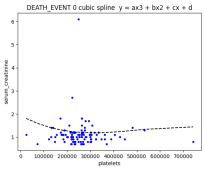
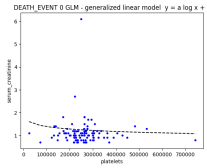
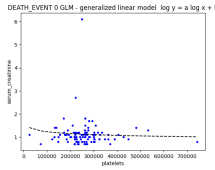
DEATH_EVENT 1 quadratic y = ax2 + bx + c
a= -3.3031525965964895e-06 b= 3.2346287979391846e-12 c= 2.7690300189853287
SSE = 1880.9249439069777

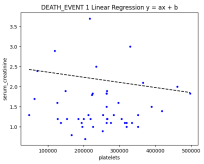
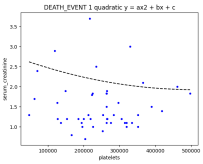
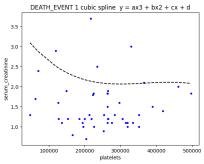
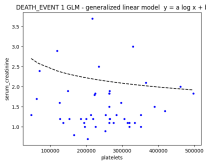
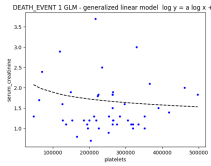
DEATH_EVENT 1 cubic spline y = ax3 + bx2 + cx + d
a= -1.3786312676545847e-05 b= 3.86617197146506e-11 c= -3.485810742248089e-17 d= 3.6650200472350765
SSE = 2019.1768235544728

DEATH_EVENT 1 GLM - generalized linear model y = a log x + b
a= -0.33176558999341255 b= 6.272167088068326
SSE = 1891.2805972511596

DEATH_EVENT 1 GLM - generalized linear model log y = a log x + b
a= -0.1288125100482462 b= 2.116752958308727
SSE = 920.4136605918726

Model	SSE (death event=0)	SSE (death event=1)
y = ax + b	3635.209589	1844.423107
y = ax2 + bx + c	3659.124040	1880.924944
y = ax3 + bx2 + cx + d	3700.463859	2019.176824
y = a log x + b	3673.075892	1891.280597
log y = a log x + b	3497.739370	920.413661

Death Event	y = ax + b	y = ax2 + bx + c	y = ax3 + bx2 + cx + d	y = a log x + b	log y = a log x + b
Death Event 0					

Death Event	y = ax + b	y = ax2 + bx + c	y = ax3 + bx2 + cx + d	y = a log x + b	log y = a log x + b
Death Event 1					

Q3.

Group - 1 ['creatinine_phosphokinase', 'platelets']

Model	SSE (death event=0)	SSE (death event=1)
y = ax + b	8.626828e+13	2.167313e+13
y = ax2 + bx + c	8.585852e+13	2.290818e+13
y = ax3 + bx2 + cx + d	3.089813e+14	2.311046e+13
y = a log x + b	8.540431e+13	2.166298e+13
log y = a log x + b	8.512980e+13	2.112085e+13

Group - 2 ['platelets', 'serum_sodium']

Model	SSE (death event=0)	SSE (death event=1)
y = ax + b	182761.281691	41335.789322
y = ax2 + bx + c	186733.469296	41971.366737
y = ax3 + bx2 + cx + d	187456.011601	42334.602886
y = a log x + b	183492.542321	42710.777656
log y = a log x + b	183964.456161	43330.572836

Group - 3 ['serum_sodium', 'serum_creatinine']

Model	SSE (death event=0)	SSE (death event=1)
y = ax + b	3874.059249	1711.028583
y = ax2 + bx + c	6039.196371	1752.299789
y = ax3 + bx2 + cx + d	10011.984479	1749.084107
y = a log x + b	3901.903094	1706.019568
log y = a log x + b	3660.488594	933.860074

Group - 4 ['platelets', 'serum_creatinine']

Model	SSE (death event=0)	SSE (death event=1)
y = ax + b	3635.209589	1844.423107
y = ax2 + bx + c	3659.124040	1880.924944
y = ax3 + bx2 + cx + d	3700.463859	2019.176824
y = a log x + b	3673.075892	1891.280597
log y = a log x + b	3497.739370	920.413661

Q3 1.

Group - 1 ['creatinine_phosphokinase', 'platelets']
Best Model(Smallest SSE) Death event 0 - y = ax3 + bx2 + cx + d
Best Model(Smallest SSE) Death event 1 - log y = a log x + b

Group - 2 ['platelets', 'serum_sodium']
Best Model(Smallest SSE) Death event 0 - y = ax + b
Best Model(Smallest SSE) Death event 1 - y = ax2 + bx + c

Group - 3 ['serum_sodium', 'serum_creatinine']
Best Model(Smallest SSE) Death event 0 - log y = a log x + b
Best Model(Smallest SSE) Death event 1 - log y = a log x + b

Group - 4 ['platelets', 'serum_creatinine']
Best Model(Smallest SSE) Death event 0 - log y = a log x + b
Best Model(Smallest SSE) Death event 1 - log y = a log x + b

Q3 2.

Group - 1 ['creatinine_phosphokinase', 'platelets']
Worst Model(Highest SSE) Death event 0 - y = ax + b
Worst Model(Highest SSE) Death event 1 - y = ax3 + bx2 + cx + d

Group - 2 ['platelets', 'serum_sodium']
Worst Model(Highest SSE) Death event 0 - y = ax3 + bx2 + cx + d
Worst Model(Highest SSE) Death event 1 - log y = a log x + b

Group - 3 ['serum_sodium', 'serum_creatinine']
Worst Model(Highest SSE) Death event 0 - y = ax3 + bx2 + cx + d
Worst Model(Highest SSE) Death event 1 - y = ax2 + bx + c

Group - 4 ['platelets', 'serum_creatinine']
Worst Model(Highest SSE) Death event 0 - y = ax3 + bx2 + cx + d
Worst Model(Highest SSE) Death event 1 - y = ax3 + bx2 + cx + d