POLYTECHNIQUE MONTRÉAL
UNIVERSITÉ D'INGÉNIERIE

Exercise 1

1) Weibull Function

a- Using Python

Data as following

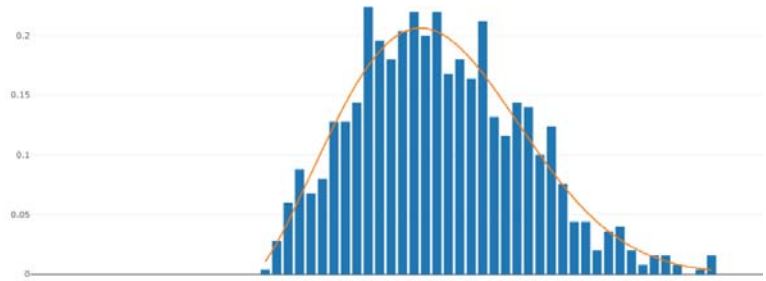
```
[ ]  # Where did you divise the matches per quarter, where you made 40 divisions
     failure_density, failure_time = np.histogram(weibull_data.time, bins=40, range=[0,10], density=True)

     # We do not want time 0 because there is no failure
     failure_time = failure_time[1:]

     print(failure_density)
     print('\n')
     print(failure_time)
```

```
[0.004 0.028 0.06  0.088 0.068 0.08  0.128 0.128 0.144 0.224 0.196 0.18
 0.204 0.22  0.2   0.22  0.168 0.18  0.164 0.212 0.132 0.116 0.144 0.14
 0.1   0.124 0.076 0.044 0.044 0.02  0.036 0.04  0.02  0.008 0.016 0.016
 0.008 0.    0.004 0.016]


[ 0.25  0.5   0.75  1.    1.25  1.5   1.75  2.    2.25  2.5   2.75  3.
  3.25  3.5   3.75  4.    4.25  4.5   4.75  5.    5.25  5.5   5.75  6.
  6.25  6.5   6.75  7.    7.25  7.5   7.75  8.    8.25  8.5   8.75  9.
  9.25  9.5   9.75 10.  ]
```

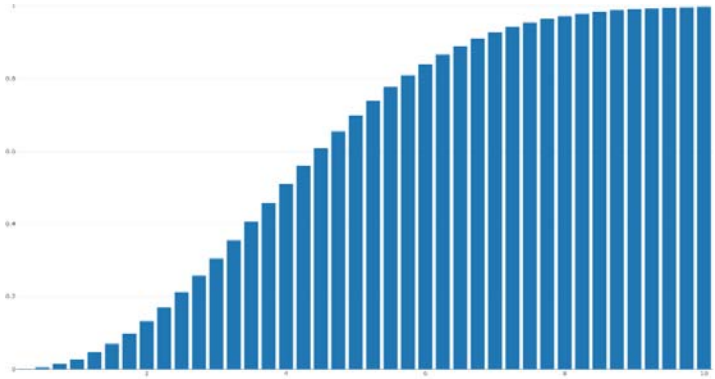
Weibull parameters to fit the given data

```
Scale parametre (lambda) = 4.62726603000104
Shape parametre (k) = 2.331309700708031
```

Predicted density Vs actual data shown by following figure



Cumulative Weibull function as figure

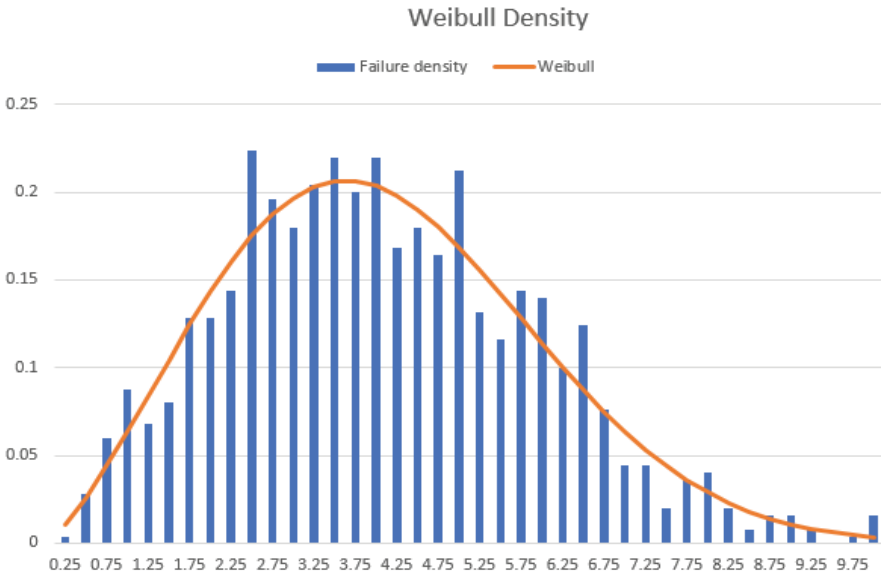


b- Using Excel

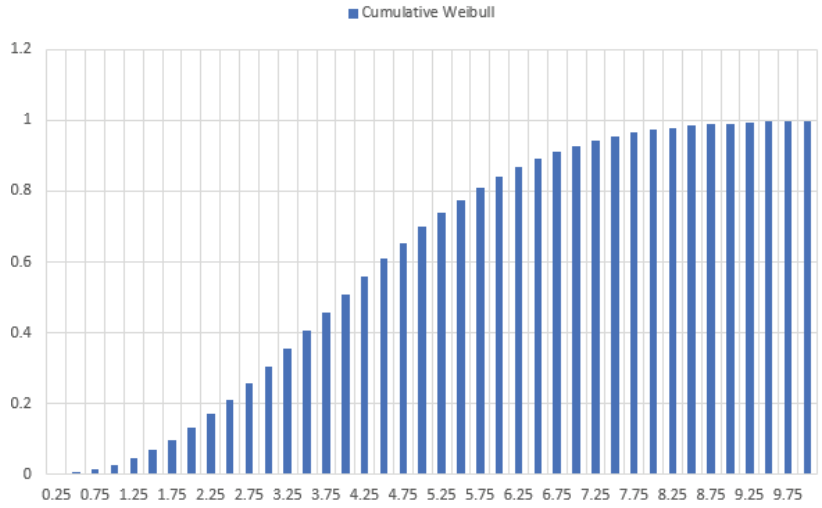
Weibull parameters to fit the given data

Weibull	
shape	2.331309
scale	4.627262

Predicted density Vs actual data shown by following figure



Cumulative Weibull function as figure



2) Exponential Function

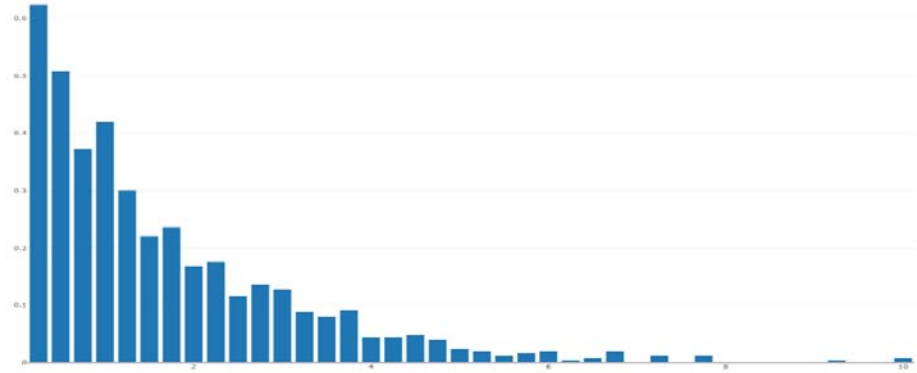
a. Using Python

Exponential Data as following

```
# On veut diviser les données par trimèstre, donc on fait 40 divisions
failure_density, failure_time = np.histogram(exponential_data.time, bins=40, range=[0,10], density=True)

# On ne veut pas le temps 0, car il n'y a aucune défaillanc#to remove it from the histogram plot
failure_time = failure_time[1:]

print(failure_density)
print('\n') # to insert empty line
print(failure_time)
```

```
[0.624 0.508 0.372 0.42  0.3   0.22  0.236 0.168 0.176 0.116 0.136 0.128
 0.088 0.08  0.092 0.044 0.044 0.048 0.04  0.024 0.02  0.012 0.016 0.02
 0.004 0.008 0.02  0.    0.012 0.    0.012 0.    0.    0.    0.    0.
 0.004 0.    0.    0.008]


[ 0.25  0.5   0.75  1.    1.25  1.5   1.75  2.    2.25  2.5   2.75  3.
  3.25  3.5   3.75  4.    4.25  4.5   4.75  5.    5.25  5.5   5.75  6.
  6.25  6.5   6.75  7.    7.25  7.5   7.75  8.    8.25  8.5   8.75  9.
  9.25  9.5   9.75 10.  ]
```

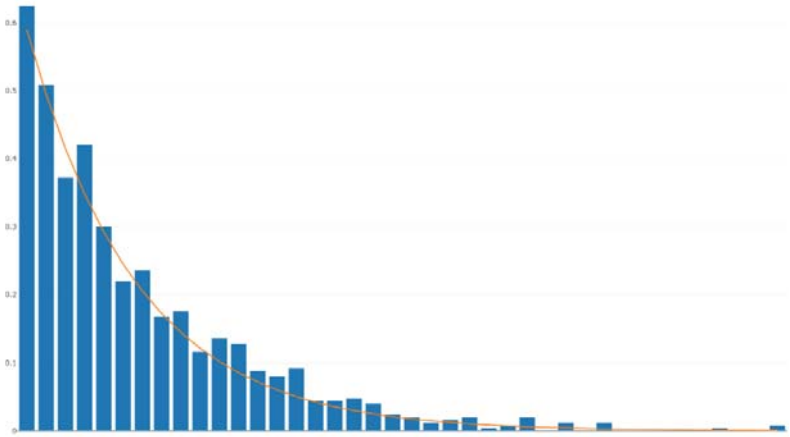
Exponential given data plot



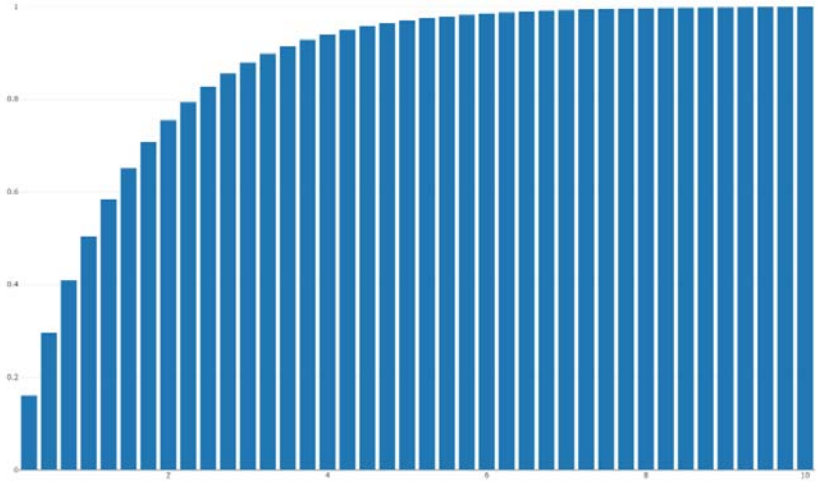
Exponential parameters to fit the given data $\lambda = 0.7024$

```
Scale parametre (lambda) = 0.7024817060962806
```

Predicted density Vs actual data shown by following figure



Cumulative Exponential function as figure

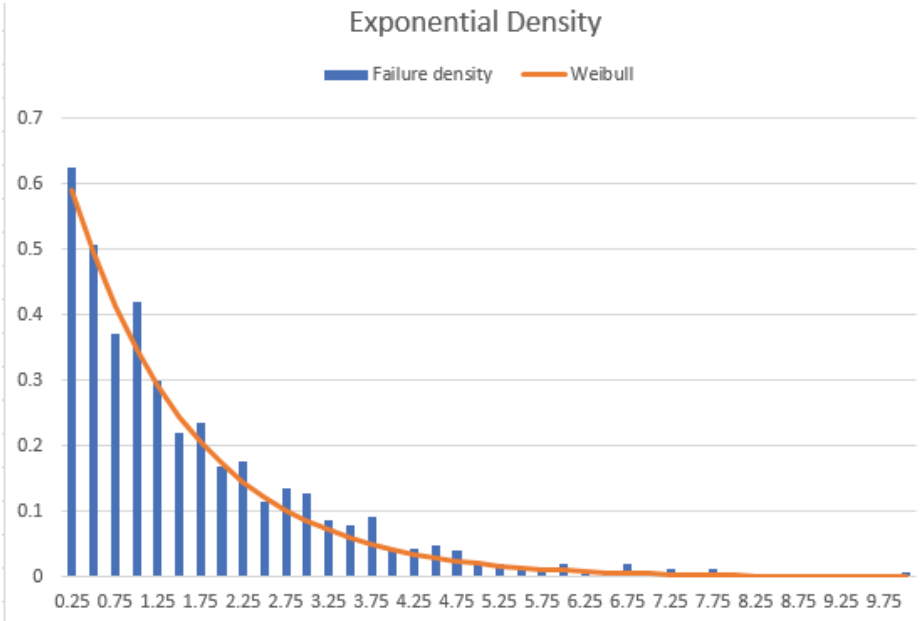


a- Exponential Using Excel

Exponential parameters to fit the given data

Exponential	
scale	0.702482

Predicted density Vs actual data shown by following figure



Cumulative Weibull function as figure