

```

In[120]:= (* Adam Beck *)
(* Problem 1*)

(* hosp-heart.nb data *)

(* {M,V} M = one year mortality rate,
percentage of patients that died within one year of the
transplant operation,
V = average annual number of transplants at that center during the same 4 years *)
heart = {{17.9, 27}, {23.1, 4}, {40, 3}, {6.5, 35}, {14.9, 17}, {12.5, 4}, {15.7, 45},
{9.8, 28}, {24, 6}, {5.0, 10}, {15.4, 13}, {4.8, 7}, {0, 1}, {19.1, 47}, {4.5, 6},
{15, 56}, {12.5, 4}, {33.9, 8}, {10.7, 9}, {13, 14}, {28.3, 12}, {57.1, 2}, {6.3, 4},
{10, 3}, {8.3, 12}, {17.5, 10}, {20, 3}, {29.3, 10}, {21.4, 7}, {27.3, 8}, {13.6, 6},
{21.8, 30}, {36.4, 3}, {18.2, 11}, {33.3, 2}, {20, 4}, {38.5, 7}, {20.8, 18}, {12.2, 19},
{22.2, 18}, {29, 8}, {0, 9}, {5.7, 9}, {50, 2}, {21.7, 15}, {66.7, 4}, {29.4, 17},
{12.1, 27}, {10.7, 14}, {6.3, 4}, {16.2, 9}, {21.1, 5}, {17.4, 33}, {23.9, 17},
{42.9, 2}, {40, 2}, {6.7, 15}, {44.4, 3}, {18.7, 34}, {14.7, 24}, {7.4, 7}, {12.6, 24},
{9.7, 26}, {44.4, 2}, {16.7, 6}, {15.8, 14}, {83.3, 2}, {10.9, 22}, {13.3, 5},
{11.1, 5}, {75, 2}, {19, 20}, {14, 13}, {60, 1}, {21.2, 8}, {9.7, 8}, {50, 2}, {25, 14},
{18.6, 15}, {0.0, 1}, {35.3, 9}, {23.5, 85}, {15.6, 11}, {37.5, 2}, {14.3, 28},
{14.3, 4}, {16.7, 6}, {20.0, 15}, {13.0, 17}, {9.6, 26}, {66.7, 3}, {30.8, 3},
{14.0, 13}, {27.5, 10}, {37.5, 8}, {18.9, 13}, {0.0, 4}, {12.2, 44}, {57.1, 4},
{21.4, 35}, {23.4, 16}, {10.9, 12}, {15.6, 8}, {16.7, 2}, {13.9, 9}, {18.2, 11},
{11.5, 26}, {18.4, 13}, {16.7, 3}, {20.4, 14}, {40.0, 5}, {20.7, 56}, {19.6, 13},
{13.5, 9}, {29.9, 36}, {8.4, 21}, {28.4, 24}, {7.7, 23}, {19.3, 29}, {0.0, 1},
{22.2, 20}, {30.0, 5}, {7.0, 11}, {23.8, 7}, {18.8, 29}, {14.5, 16}, {17.0, 16},
{20.0, 15}, {6.7, 15}, {11.4, 20}, {100.0, 1}, {31.4, 9}, {17.6, 26}, {19.6, 14}};

In[121]:= (* Split this M and V data into separate
lists via Transpose[] in order to parse through *)
heartTranspose = Transpose[heart];
MData = heartTranspose[[1]];
VData = heartTranspose[[2]];

(* Define mean, median, quantile, and variance functions *)

In[125]:= mean[x_] := Sum[x[[i]], {i, 1, Length[x]}] / Length[x];
(* Sum elements, divide by length *)

In[126]:= median[x_] := (s = Sort[x]; s[[IntegerPart[.5 * Length[s]]]]);
(* Sort list, take element at index 1/2*length *)

In[169]:= quantile[x_, alpha_] := (s = Sort[x]; s[[IntegerPart[alpha * Length[s]]]]);
(* Sort list, take element at index .alpha*length *)

In[128]:= variance[x_] := (m = mean[x]; Sum[(x[[i]] - m)^2, {i, 1, Length[x]}] / Length[x]);
(* difference of every element from mean, squared, times 1/length *)

In[129]:= (* Find the mean, median, q1 and q3, and variance *)
hospMeanM = mean[MData]

Out[129]= 21.9045

```

```
In[130]:= hospMeanV = N[mean[VData]]
```

```
Out[130]:= 13.8657
```

```
In[131]:= hospMedianM = median[MData]
```

```
Out[131]:= 18.2
```

```
In[132]:= hospMedianV = median[VData]
```

```
Out[132]:= 10
```

```
In[171]:= hospQ1M = quantile[MData, .25]
```

```
Out[171]:= 12.2
```

```
In[172]:= hospQ1V = quantile[VData, .25]
```

```
Out[172]:= 4
```

```
In[173]:= hospQ2M = quantile[MData, .75]
```

```
Out[173]:= 25
```

```
In[175]:= hospQ2V = quantile[VData, .75]
```

```
Out[175]:= 17
```

```
In[140]:= hospVarianceM = variance[MData]
```

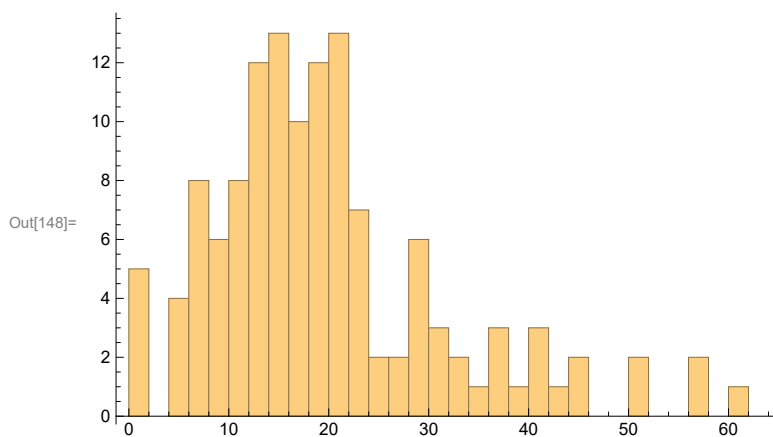
```
Out[140]:= 268.634
```

```
In[142]:= hospVarianceV = N[variance[VData]]
```

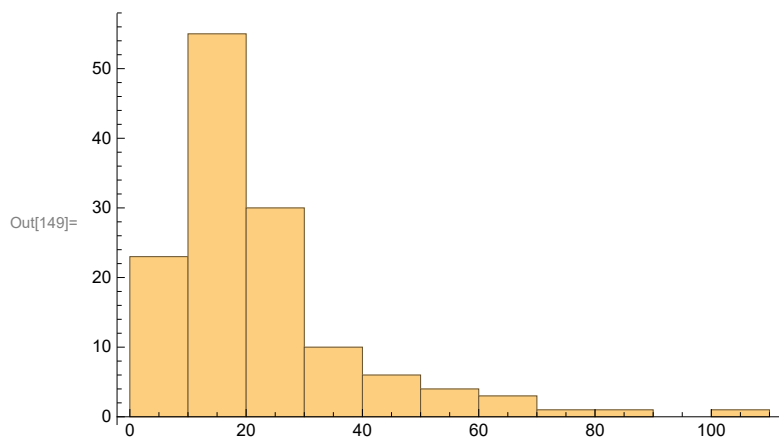
```
Out[142]:= 166.46
```

```
In[148]:= (* Histograms using two different bin sizes *)
(* I will use a bin size Length/2 for a very large bin,
and Length/10 for a smaller bin *)
```

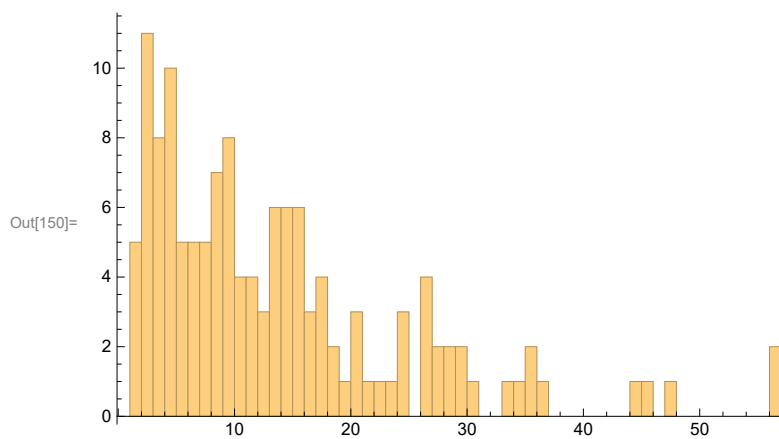
```
(* MData large bin *)
Histogram[MData, IntegerPart[Length[MData] / 2]]
```



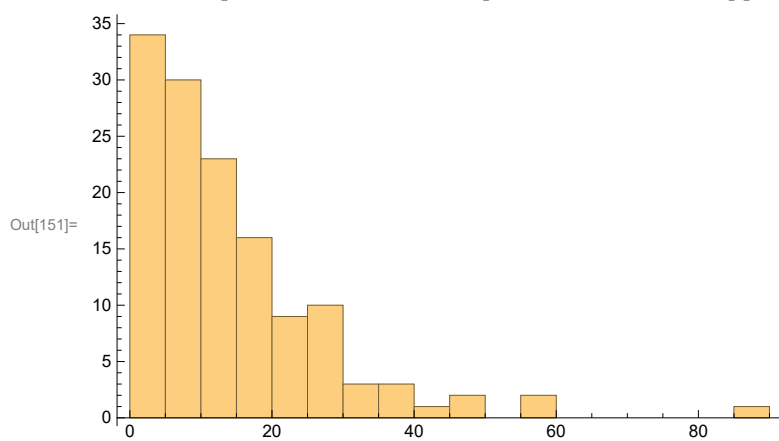
```
In[149]:= (* MData small bin *)
Histogram[MData, IntegerPart[Length[MData] / 10]]
```



```
In[150]:= (* VData, large bin *)
Histogram[VData, IntegerPart[Length[VData] / 2]]
```



```
In[151]:= (* VData, small bin *)
Histogram[VData, IntegerPart[Length[VData] / 10]]
```



```
(* Product plots of quantile functions, moment functions, and CDFs *)
```

```
(* Define functions for moments and CDF *)
```

```
(* Sum elements raised to the kth power, divide by length *)
```

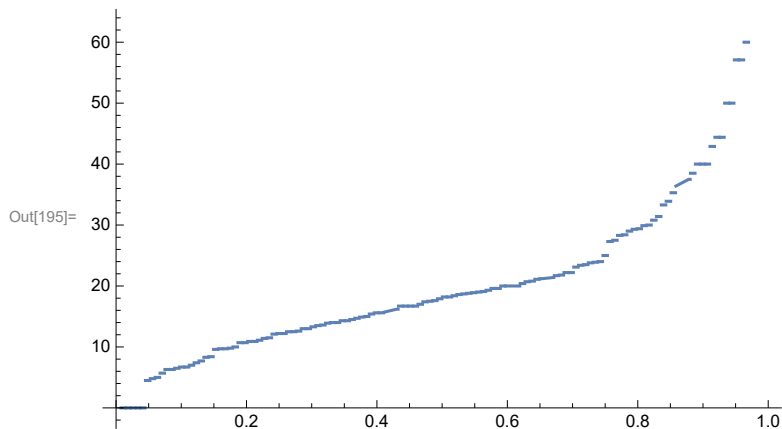
```
moment[x_, k_] := N[Sum[x[[i]]^k, {i, 1, Length[x]}] / Length[x];
```

```
In[168]:= cdf[x_, xi_] := N[Sum[If[x[[i]] <= xi, 1, 0], {i, 1, Length[x]}];  
(* Count that an element is less than or equal to a given element *)
```

```
(* Plot the quantile functions *)
```

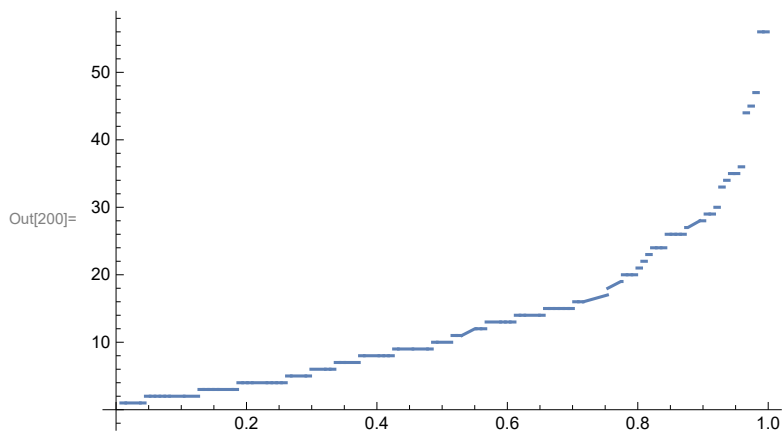
```
(* MData *)
```

```
Plot[quantile[MData, i], {i, 0, 1}]
```



```
In[200]:= (* VData *)
```

```
Plot[quantile[VData, i], {i, 0, 1}]
```



```
In[209]:= (* Plot moment functions *)
```

```
(* Get the first 10 moments for MData and VData in a Table *)
```

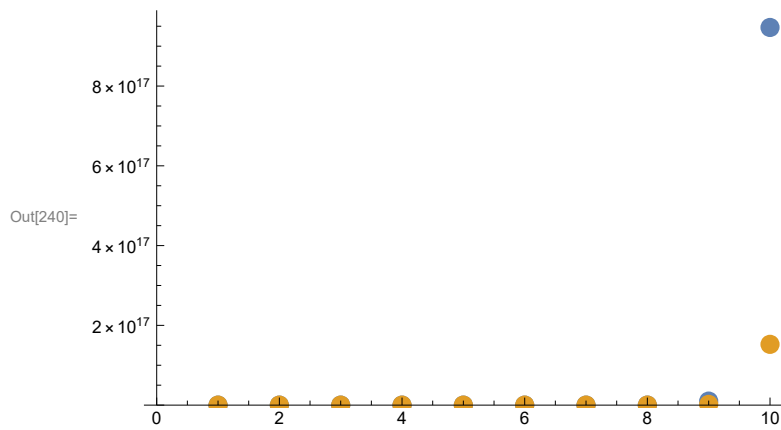
```
momMData = Table[moment[MData, i], {i, 1, 10}];
```

```
In[210]:= momVData = Table[moment[VData, i], {i, 1, 10}];
```

(* Plot the two moments *)

ListPlot[{momMData, momVData}, PlotStyle → PointSize[.03], PlotRange → {0, 9.9×10^{17} }]

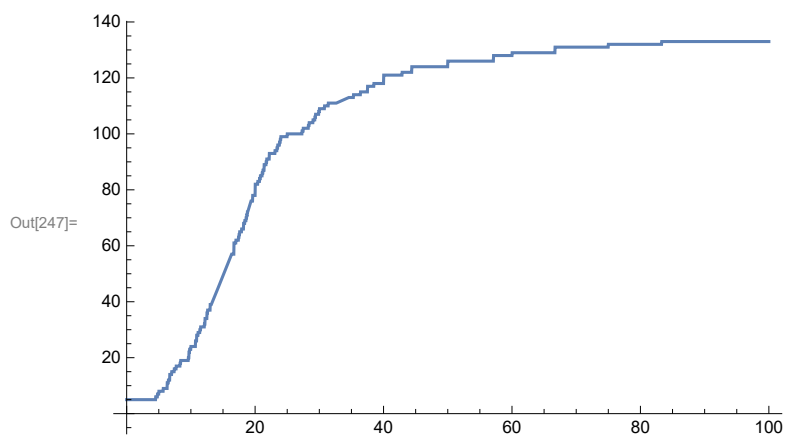
(* Blue is MData *)



(* Plot CDF functions *)

(* MData *)

Plot[cdf[MData, i], {i, 0, Max[MData]}]



In[250]:= (* VData *)

Plot[cdf[VData, i], {i, 0, Max[VData]}]

