In[31]:=
```
(* Problem 1 *)

(* Create 3 different sized random arrays *)
small = RandomInteger[{0, 1}, 50];
medium = RandomInteger[{0, 1}, 500];
large = RandomInteger[{0, 1}, 5000];

(* Equipartition of small *)
(* 0 and 1 *)
smallfrq1 = N[Sum[small[[i]], {i, 1, Length[small]}]] / Length[small]
```

Out[34]= 0.42

In[35]:=
```
smallfrq0 = 1 - smallfrq1
```

Out[35]= 0.58

```
(* 00, 01, 10, 11 *)
```

In[36]:=
$$\text{smallfrq00} = N\left[\sum_{k=1}^{\text{Length[small]}-1} ((1 - \text{small}[[k]]) * (1 - \text{small}[[k+1]])) / (\text{Length[small]} - 1)\right]$$

Out[36]= 0.306122

```
NumberForm[smallfrq01, 16]
```

In[37]:=
$$\text{smallfrq01} = N\left[\sum_{k=1}^{\text{Length[small]}-1} ((1 - \text{small}[[k]]) * (\text{small}[[k+1]])) / (\text{Length[small]} - 1)\right]$$

Out[37]= 0.265306

In[38]:=
$$\text{smallfrq10} = N\left[\sum_{k=1}^{\text{Length[small]}-1} ((\text{small}[[k]]) * (1 - \text{small}[[k+1]])) / (\text{Length[small]} - 1)\right]$$

Out[38]= 0.285714

In[39]:=
```
smallfrq11 = 1 - smallfrq00 - smallfrq01 - smallfrq10
```

Out[39]= 0.142857

In[8]:=
```
(* 000, 001, 010, 011, 100, 101, 110, 111 *)
```
$$\text{smallfrq000} = N\left[\sum_{k=1}^{\text{Length[small]}-2} ((1 - \text{small}[[k]]) * (1 - \text{small}[[k+1]]) * (1 - \text{small}[[k+2]])) / (\text{Length[small]} - 2)\right]$$

Out[8]= 0.0833333

In[9]:=
$$N\left[\sum_{k=1}^{\text{Length[small]}-2} ((1 - \text{small}[[k]]) * (1 - \text{small}[[k+1]]) * (\text{small}[[k+2]])) / (\text{Length[small]} - 2)\right]$$

Out[9]= 0.145833

In[10]:=
```
smallfrq010 = N[
  Sum[((1 - small[[k]]) * (small[[k + 1]]) * (1 - small[[k + 2]])) / (Length[small] - 2), {k, 1, Length[small] - 2}]]
```

Out[10]= 0.145833

In[11]:=
```
smallfrq011 =
 N[Sum[((1 - small[[k]]) * (small[[k + 1]]) * (small[[k + 2]])) / (Length[small] - 2), {k, 1, Length[small] - 2}]]
```

Out[11]= 0.125

In[12]:=
```
smallfrq100 = N[
  Sum[((small[[k]]) * (1 - small[[k + 1]]) * (1 - small[[k + 2]])) / (Length[small] - 2), {k, 1, Length[small] - 2}]]
```

Out[12]= 0.166667

In[14]:=
```
smallfrq101 =
 N[Sum[((small[[k]]) * (1 - small[[k + 1]]) * (small[[k + 2]])) / (Length[small] - 2), {k, 1, Length[small] - 2}]]
```

Out[14]= 0.125

In[15]:=
```
smallfrq110 =
 N[Sum[((small[[k]]) * (small[[k + 1]]) * (1 - small[[k + 2]])) / (Length[small] - 2), {k, 1, Length[small] - 2}]]
```

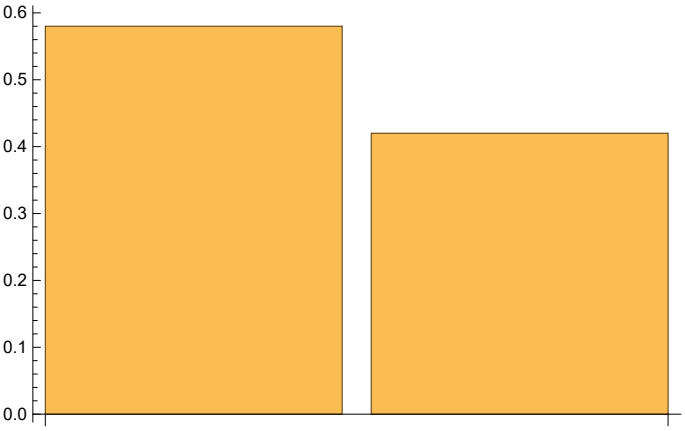
Out[15]= 0.145833

In[17]:=
```
smallfrq111 =
 N[Sum[((small[[k]]) * (small[[k + 1]]) * (small[[k + 2]])) / (Length[small] - 2), {k, 1, Length[small] - 2}]]
```

Out[17]= 0.0625

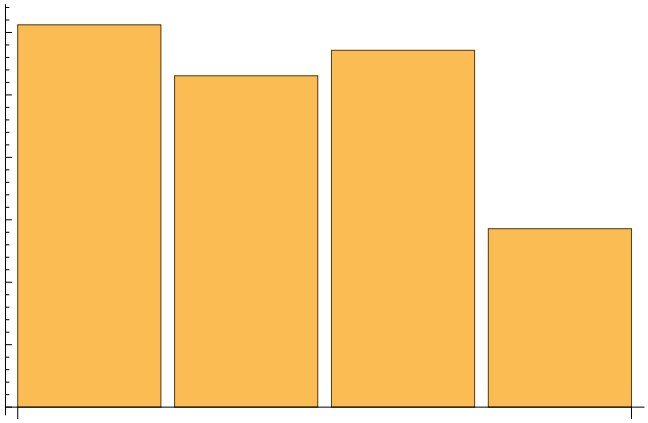
In[40]:=
```
(* Graphing small *)
BarChart[{smallfrq0, smallfrq1}]
```

Out[40]=



In[41]:=
```
BarChart[{smallfrq00, smallfrq01, smallfrq10, smallfrq11}]
```

Out[41]=



In[42]:=
```
BarChart[{smallfrq000, smallfrq001, smallfrq010,
  smallfrq011, smallfrq100, smallfrq101, smallfrq110, smallfrq111}]
```

Out[42]=