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}]]
```

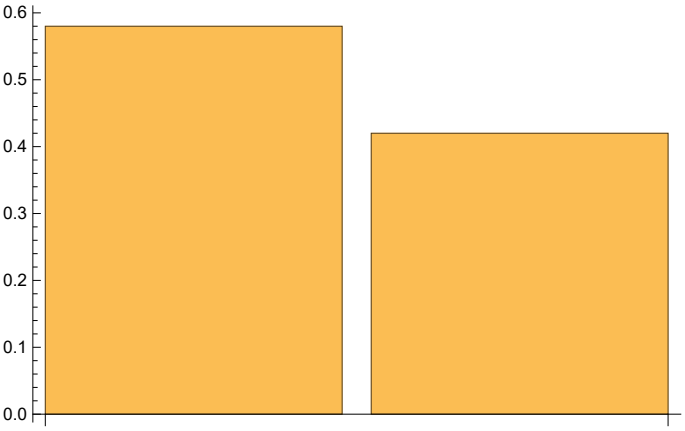
Out[15]= 0.145833

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

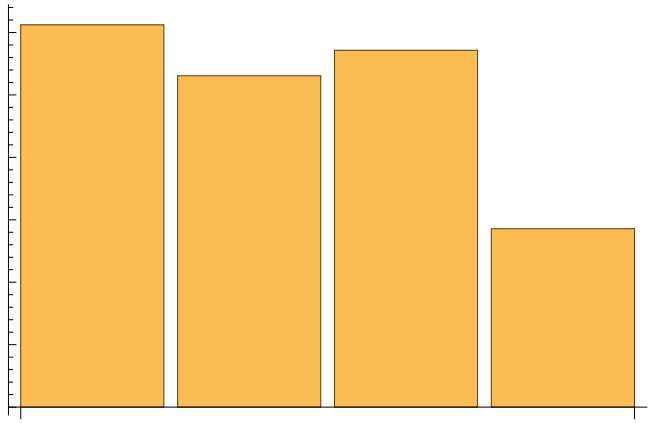
In[40]:=
```
(* Graphing small *)
BarChart[{smallfrq0, smallfrq1}]
```

Out[40]=



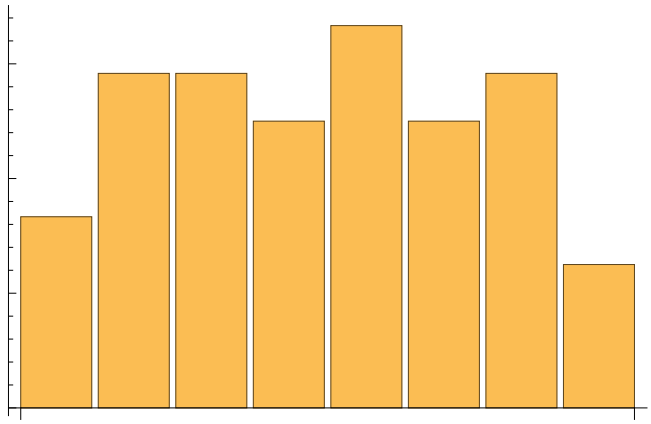
In[41]:=
```
BarChart[{smallfrq00, smallfrq01, smallfrq10, smallfrq11}]
```

Out[41]=



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

Out[42]=



```
(* Equipartition of medium *)
(* 0 and 1 *)
```

In[43]:=
```
mediumfrq1 = N[Sum[medium[[i]], {i, 1, Length[medium]}]] / Length[medium]
```

Out[43]= 0.476

In[45]:=
```
mediumfrq0 = 1 - mediumfrq1
```

Out[45]= 0.524

In[46]:=
```
(* 00, 01, 10, 11 *)
mediumfrq00 =
 N[ Sum[((1 - medium[[k]]) * (1 - medium[[k + 1]])), {k, 1, Length[medium] - 1}] / (Length[medium] - 1)]
```

Out[46]= 0.268537

In[48]:=
```
mediumfrq01 = N[Sum[((1 - medium[[k]]) * (medium[[k + 1]])) / (Length[medium] - 1), {k, 1, Length[medium] - 1}]]
```

Out[48]= 0.256513

In[49]:=
```
mediumfrq11 = N[Sum[((medium[[k]]) * (medium[[k + 1]])) / (Length[medium] - 1), {k, 1, Length[medium] - 1}]]
```

Out[49]= 0.218437

In[50]:=
```
mediumfrq10 = 1 - mediumfrq00 - mediumfrq01 - mediumfrq11
```

Out[50]= 0.256513

In[51]:=
```
(* 000, 001, 010, 011, 100, 101, 110, 111 *)
mediumfrq000 =
 N[Sum[((1 - medium[[k]]) * (1 - medium[[k + 1]]) * (1 - medium[[k + 2]])) /
    (Length[medium] - 2), {k, 1, Length[medium] - 2}]]
```

Out[51]= 0.138554

In[52]:=
```
mediumfrq001 = N[Sum[((1 - medium[[k]]) * (1 - medium[[k + 1]]) * (medium[[k + 2]])) /
    (Length[medium] - 2), {k, 1, Length[medium] - 2}]]
```

Out[52]= 0.130522

In[53]:=
```
mediumfrq010 = N[Sum[((1 - medium[[k]]) * (medium[[k + 1]]) * (1 - medium[[k + 2]])) /
    (Length[medium] - 2), {k, 1, Length[medium] - 2}]]
```

Out[53]= 0.148594

In[54]:=
```
mediumfrq011 = N[Sum[((1 - medium[[k]]) * (medium[[k + 1]]) * (medium[[k + 2]])) /
    (Length[medium] - 2), {k, 1, Length[medium] - 2}]]
```

Out[54]= 0.108434

In[55]:=
```
mediumfrq100 = N[Sum[((medium[[k]]) * (1 - medium[[k + 1]]) * (1 - medium[[k + 2]])) /
    (Length[medium] - 2), {k, 1, Length[medium] - 2}]]
```

Out[55]= 0.130522

In[56]:=
```
mediumfrq101 = N[Sum[((medium[[k]]) * (1 - medium[[k + 1]]) * (medium[[k + 2]])) /
    (Length[medium] - 2), {k, 1, Length[medium] - 2}]]
```

Out[56]= 0.126506

In[57]:=
```
mediumfrq110 = N[ Sum_{k=1}^{Length[medium]-2} ((medium[[k]]) * (medium[[k+1]]) * (1 - medium[[k+2]])) / (Length[medium] - 2) ]
```

Out[57]= 0.108434

In[58]:=
```
mediumfrq111 = N[ Sum_{k=1}^{Length[medium]-2} ((medium[[k]]) * (medium[[k+1]]) * (medium[[k+2]])) / (Length[medium] - 2) ]
```

Out[58]= 0.108434