Hashfunktionen

```
ub = 19;
h1[k_, n_] := Mod[k, n] + 1
h2[k_, n_] := Mod[k^2, n] + 1

h3[k_, n_] := Block[{a = (Sqrt[5] - 1) / 2}, Floor[n (k a - Inte
h4[k_, n_] := Block[{a = 3 / 10}, Floor[n (k a - IntegerPart[k a]
```

Erstellung von Hashtabellen

```
Hashing[data_, f_, hashSize_] := Module[{i, p, n, hashArray, c
  collisions = 0; maxLen = 0;
  n = Length[data] ;
  hashArray = Table[{}, {i, hashSize}];
  Do[p = f[data[[i]], hashSize];
   hashArray[[p]] = Append[hashArray[[p]], data[[i]]];
   currentLen = Length[hashArray[[p]]];
   If[currentLen > 1, collisions = collisions + 1; If[currentLe
  Print["Kollisionen    : ", collisions];
  Print["Maximale Tiefe = ", maxLen];
  Return[hashArray];]

PrintTable[hashArray_] := Module[{str}, Print["Pos: Eintrag"]
  Do[If[i < 10, str = "  :", str = " :";];
   Print[i, str, hashArray[[i]]], {i, 1, Length[hashArray]}]]
```

Daten Generieren

```
data = Table[Random[Integer, {0, 10^12}], {i, 1, ub}];
PrintTable[data]
```

```
Pos: Eintrag
1  :333830291580
2  :30557207743
3  :308695070594
4  :355951755762
5  :709213883934
6  :948449594495
7  :419695224333
8  :652626580169
9  :619530353120
10 :617269899264
11 :488249446050
12 :843954534221
13 :962505748029
14 :164121987644
15 :181593836516
16 :507808227129
17 :848124422772
18 :233836594629
19 :401345648118
```

Hashing mit Hashfunktion ’h1’

```
Table[h1[data[[i]], 19], {i, 1, 19}]
```

```
{7, 15, 13, 17, 17, 6, 7, 7, 11, 19, 16, 17, 14, 14, 19, 6, 7, 1,
```

```
hash1 = Hashing[data, h1, 19];
PrintTable[hash1]
```

```
Kollisionen    : 8
Maximale Tiefe = 4
Pos: Eintrag
1  :{233836594629}
2  :{}
3  :{401345648118}
4  :{}
5  :{}
6  :{948449594495, 507808227129}
7  :{333830291580, 419695224333, 652626580169, 848124422772}
8  :{}
9  :{}
10 :{}
11 :{619530353120}
12 :{}
13 :{308695070594}
14 :{962505748029, 164121987644}
15 :{30557207743}
16 :{488249446050}
17 :{355951755762, 709213883934, 843954534221}
18 :{}
19 :{617269899264, 181593836516}
```

```
hash1 = Hashing[data, h1, 29];
```

```
Kollisionen    : 5
Maximale Tiefe = 3
```

```
hash1 = Hashing[data, h1, 41];
```

```
Kollisionen    : 2
Maximale Tiefe = 2
```

Hashing mit Hashfunktion ’h2’

```
Table[h2[data[[i]], 19], {i, 1, 19}]
```

```
{18, 7, 12, 10, 10, 7, 18, 18, 6, 2, 17, 10, 18, 18, 2, 7, 18, 1, 5
```

```
hash2 = Hashing[data, h2, 19];
PrintTable[hash2]
```

```
Kollisionen    : 10
Maximale Tiefe = 6
Pos: Eintrag
1  :{233836594629}
2  :{617269899264, 181593836516}
3  :{}
4  :{}
5  :{401345648118}
6  :{619530353120}
7  :{30557207743, 948449594495, 507808227129}
8  :{}
9  :{}
10 :{355951755762, 709213883934, 843954534221}
11 :{}
12 :{308695070594}
13 :{}
14 :{}
15 :{}
16 :{}
17 :{488249446050}
18 :{333830291580, 419695224333, 652626580169, 962505748029,
19 :{}
```

```
hash2 = Hashing[data, h2, 29];
```

```
Kollisionen    : 9
Maximale Tiefe = 3
```

```
hash2 = Hashing[data, h2, 41];
```

```
Kollisionen    : 6
Maximale Tiefe = 2
```

Hashing mit Hashfunktion ’h3’

```
Table[h3[data[[i]], 19], {i, 1, 19}]
```

```
{14, 9, 13, 3, 11, 19, 16, 1, 8, 8, 4, 4, 2, 4, 8, 11, 19, 5, 15}
```

```
hash3 = Hashing[data, h3, 19];
PrintTable[hash3]
```

```
Kollisionen    : 6
Maximale Tiefe = 3
Pos: Eintrag
1  :{652626580169}
2  :{962505748029}
3  :{355951755762}
4  :{488249446050, 843954534221, 164121987644}
5  :{233836594629}
6  :{}
7  :{}
8  :{619530353120, 617269899264, 181593836516}
9  :{30557207743}
10 :{}
11 :{709213883934, 507808227129}
12 :{}
13 :{308695070594}
14 :{333830291580}
15 :{401345648118}
16 :{419695224333}
17 :{}
18 :{}
19 :{948449594495, 848124422772}
```

```
hash3 = Hashing[data, h3, 29];
```

```
Kollisionen    : 3
Maximale Tiefe = 2
```

```
hash3 = Hashing[data, h3, 41];
```

```
Kollisionen    : 3
Maximale Tiefe = 3
```

Hashing mit Hashfunktion ’h4’

```
Table[h4[data[[i]], 19], {i, 1, 19}]
```

```
{1, 18, 4, 12, 4, 10, 18, 14, 1, 4, 1, 6, 14, 4, 16, 14, 12, 14, 8
```

```
hash4 = Hashing[data, h4, 19];
PrintTable[hash4]
```

```
Kollisionen    : 10
Maximale Tiefe = 4
Pos: Eintrag
1  :{333830291580, 619530353120, 488249446050}
2  :{}
3  :{}
4  :{308695070594, 709213883934, 617269899264, 164121987644}
5  :{}
6  :{843954534221}
7  :{}
8  :{401345648118}
9  :{}
10 :{948449594495}
11 :{}
12 :{355951755762, 848124422772}
13 :{}
14 :{652626580169, 962505748029, 507808227129, 233836594629}
15 :{}
16 :{181593836516}
17 :{}
18 :{30557207743, 419695224333}
19 :{}
```

```
hash4 = Hashing[data, h4, 29];
```

```
Kollisionen     : 10
Maximale Tiefe = 4
```

```
hash4 = Hashing[data, h4, 41];
```

```
Kollisionen     : 10
Maximale Tiefe = 4
```

Daten Generieren (50000)

```
n = Prime[5134]; n
```

```
50021
```

```
n1 = Prime[5600] ; n1 (* Hashtabelle ca. 10 % groesser *)
```

```
55103
```

```
n2 = Prime[6500] ; n2 (*Hashtabelle ca. 30 % groesser*)
```

```
65063
```

```
data = Table[Random[Integer, {0, 10^12}], {i, 1, 50000}] ; (*
```

Hashfunktion ’h1’

```
hash1 = Hashing[data, h1, n];
```

```
Kollisionen     : 18408
Maximale Tiefe = 7
```

```
hash1 = Hashing[data, h1, n1];
```

```
Kollisionen     : 17192
Maximale Tiefe = 7
```

```
hash1 = Hashing[data, h1, n2];
```

```
Kollisionen     : 15086
Maximale Tiefe = 6
```

Hashfunktion ’h2’

```
hash2 = Hashing[data, h2, n];
```

```
Kollisionen     : 28389
Maximale Tiefe = 10
```

```
hash2 = Hashing[data, h2, n1];
```

```
Kollisionen     : 27028
Maximale Tiefe = 9
```

```
hash2 = Hashing[data, h2, n2];
```

```
Kollisionen     : 24428
Maximale Tiefe = 9
```

Hashfunktion ’h3’

```
hash3 = Hashing[data, h3, n];
```

```
Kollisionen     : 18462
Maximale Tiefe = 7
```

```
hash3 = Hashing[data, h3, n1];
```

```
Kollisionen     : 17173
Maximale Tiefe = 7
```

```
hash3 = Hashing[data, h3, n 2];
```

```
Kollisionen     : 10726
Maximale Tiefe = 6
```

Hashfunktion ’h4’

```
hash4 = Hashing[data, h4, n];
```

```
Kollisionen     : 49990
Maximale Tiefe = 5109
```

```
hash4 = Hashing[data, h4, n1];
```

```
Kollisionen     : 49990
Maximale Tiefe = 5109
```

```
hash4 = Hashing[data, h4, n2];
```

```
Kollisionen     : 49990
Maximale Tiefe = 5109
```

```
Prime[5134]
```

```
50021
```