

Pensieve header: Sep 15: Textbook (EIWL) chapters 1-4.

I. Starting Out: Elementary Arithmetic

$$2 + 2$$

$$4$$

$$1234 + 5678$$

$$6912$$

$$1234 * 5678$$

$$7\ 006\ 652$$

$$2/3 + 1/4$$

$$\frac{11}{12}$$

$$12$$

1000 !

402 387 260 077 093 773 543 702 433 923 003 985 719 374 864 210 714 632 543 799 910 429 938 512 398 629 \
020 592 044 208 486 969 404 800 479 988 610 197 196 058 631 666 872 994 808 558 901 323 829 669 944 590 \
997 424 504 087 073 759 918 823 627 727 188 732 519 779 505 950 995 276 120 874 975 462 497 043 601 418 \
278 094 646 496 291 056 393 887 437 886 487 337 119 181 045 825 783 647 849 977 012 476 632 889 835 955 \
735 432 513 185 323 958 463 075 557 409 114 262 417 474 349 347 553 428 646 576 611 667 797 396 668 820 \
291 207 379 143 853 719 588 249 808 126 867 838 374 559 731 746 136 085 379 534 524 221 586 593 201 928 \
090 878 297 308 431 392 844 403 281 231 558 611 036 976 801 357 304 216 168 747 609 675 871 348 312 025 \
478 589 320 767 169 132 448 426 236 131 412 508 780 208 000 261 683 151 027 341 827 977 704 784 635 868 \
170 164 365 024 153 691 398 281 264 810 213 092 761 244 896 359 928 705 114 964 975 419 909 342 221 566 \
832 572 080 821 333 186 116 811 553 615 836 546 984 046 708 975 602 900 950 537 616 475 847 728 421 889 \
679 646 244 945 160 765 353 408 198 901 385 442 487 984 959 953 319 101 723 355 556 602 139 450 399 736 \
280 750 137 837 615 307 127 761 926 849 034 352 625 200 015 888 535 147 331 611 702 103 968 175 921 510 \
907 788 019 393 178 114 194 545 257 223 865 541 461 062 892 187 960 223 838 971 476 088 506 276 862 967 \
146 674 697 562 911 234 082 439 208 160 153 780 889 893 964 518 263 243 671 616 762 179 168 909 779 911 \
903 754 031 274 622 289 988 005 195 444 414 282 012 187 361 745 992 642 956 581 746 628 302 955 570 299 \
024 324 153 181 617 210 465 832 036 786 906 117 260 158 783 520 751 516 284 225 540 265 170 483 304 226 \
143 974 286 933 061 690 897 968 482 590 125 458 327 168 226 458 066 526 769 958 652 682 272 807 075 781 \
391 858 178 889 652 208 164 348 344 825 993 266 043 367 660 176 999 612 831 860 788 386 150 279 465 955 \
131 156 552 036 093 988 180 612 138 558 600 301 435 694 527 224 206 344 631 797 460 594 682 573 103 790 \
084 024 432 438 465 657 245 014 402 821 885 252 470 935 190 620 929 023 136 493 273 497 565 513 958 720 \
559 654 228 749 774 011 413 346 962 715 422 845 862 377 387 538 230 483 865 688 976 461 927 383 814 900 \
140 767 310 446 640 259 899 490 222 221 765 904 339 901 886 018 566 526 485 061 799 702 356 193 897 017 \
860 040 811 889 729 918 311 021 171 229 845 901 641 921 068 884 387 121 855 646 124 960 798 722 908 519 \
296 819 372 388 642 614 839 657 382 291 123 125 024 186 649 353 143 970 137 428 531 926 649 875 337 218 \
940 694 281 434 118 520 158 014 123 344 828 015 051 399 694 290 153 483 077 644 569 099 073 152 433 278 \
288 269 864 602 789 864 321 139 083 506 217 095 002 597 389 863 554 277 196 742 822 248 757 586 765 752 \
344 220 207 573 630 569 498 825 087 968 928 162 753 848 863 396 909 959 826 280 956 121 450 994 871 701 \
244 516 461 260 379 029 309 120 889 086 942 028 510 640 182 154 399 457 156 805 941 872 748 998 094 254 \
742 173 582 401 063 677 404 595 741 785 160 829 230 135 358 081 840 096 996 372 524 230 560 855 903 700 \
624 271 243 416 909 004 153 690 105 933 983 835 777 939 410 970 027 753 472 000 000 000 000 000 000 000 \
000 \
000 \
000 000

Log[100 !]

Log[
93 326 215 443 944 152 681 699 238 856 266 700 490 715 968 264 381 621 468 592 963 895 217 599 993 229 \
915 608 941 463 976 156 518 286 253 697 920 827 223 758 251 185 210 916 864 000 000 000 000 000 000 000 \
000]

N[Log[100 !]]

363.739

N[Log[100 !], 300]

363.739375555563490144079993369655638027823921062887274727679448876775944447979019914101 \
000241972549319615773559722930531198015034891504259440521518363651213933980097257016866 \
500151787333959097149972931579326618804901845544962787772206012534615175680069462456089 \
297581300079220946653779448248429292399

```
Zeta[1 + 1 I]
```

```
Zeta[1 + i]
```

```
N[Zeta[1 + i]]
```

```
0.582158 - 0.926849 i
```

```
Zeta[1 + 1 I] // N
```

```
0.582158 - 0.926849 i
```

```
N@Zeta[1 + 1 I]
```

```
0.582158 - 0.926849 i
```

2. Introducing Functions (should have been “Expressions”)

leonard asked about cells

```
leonrad asked about cells
```

```
about asked cells leonrad
```

```
Plus[3, 4]
```

```
7
```

```
Plus[1, 2, 3]
```

```
6
```

```
Times[2, 3]
```

```
6
```

```
Times[2, Plus[2, 3]]
```

```
10
```

```
2 (2 + 3)
```

```
10
```

```
Max[2, 7, 3]
```

```
7
```

```
RandomInteger[100]
```

```
15
```

```
100 // Factorial // Log // N
```

```
363.739
```

```
Hold[1 + 1]
```

```
Hold[1 + 1]
```

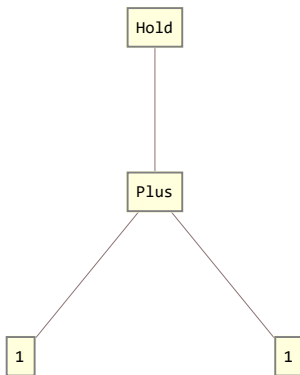
```
Hold[100 // Factorial // Log // N]
```

```
Hold[N[Log[100!]]]
```

```
TreeForm[1 + 1]
```

2

```
Hold[1 + 1] // TreeForm
```



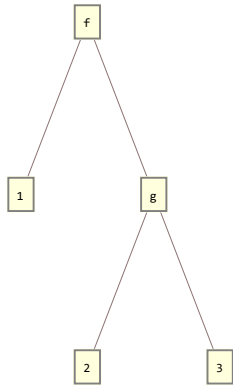
```
Hold[1 + 1] // TreeForm // FullForm
```

```
TreeForm[Hold[Plus[1, 1]]]
```

```
f[1, g[2, 3]]
```

```
f[1, g[2, 3]]
```

`f[1, g[2, 3]] // TreeForm`



3. First Look at Lists

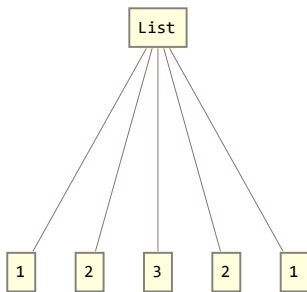
`{1, 2, 3, 4, a, b, c}`

`{1, 2, 3, 4, a, b, c}`

`l = {1, 2, 3, 2, 1}`

`{1, 2, 3, 2, 1}`

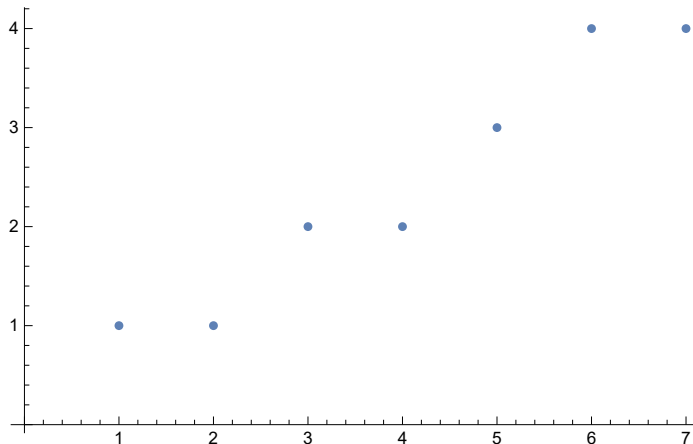
`l // TreeForm`



`List[1, 2, 3]`

`{1, 2, 3}`

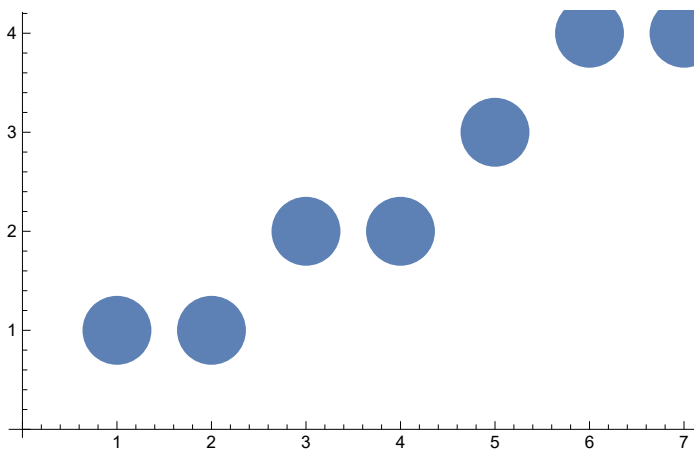
```
ListPlot[{1, 1, 2, 2, 3, 4, 4}]
```



```
ListPlot[{1, 1, 2, 2, 3, 4, 4}] // FullForm
```

```
Graphics[List[List[], List[
  List[List[], List[Hue[0.67`, 0.6`, 0.6`], Directive[PointSize[0.012833333333333334`],
    RGBColor[0.368417`, 0.506779`, 0.709798`], AbsoluteThickness[1.6`]],
  Point[List[List[1.`, 1.`, List[2.`, 1.`, List[3.`, 2.`, List[4.`, 2.`,
    List[5.`, 3.`, List[6.`, 4.`, List[7.`, 4.`, ]]]], List[]]],
  List[], List[], List[List[], List[]], List[List[], List[]]],
List[Rule[DisplayFunction, Identity],
Rule[PlotRangePadding,
  List[List[Scaled[0.02`], Scaled[0.02`]], List[Scaled[0.02`], Scaled[0.05`]]]],
Rule[AxesOrigin, List[0.`, 0]], Rule[PlotRange, List[List[0.`, 7.`, List[0, 4.`, ]]],
Rule[PlotRangeClipping, True], Rule[ImagePadding, All],
Rule[DisplayFunction, Identity],
Rule[AspectRatio, Power[GoldenRatio, -1]],
Rule[Axes, List[True, True]], Rule[AxesLabel, List[None, None]],
Rule[AxesOrigin, List[0.`, 0]], RuleDelayed[DisplayFunction, Identity],
Rule[Frame, List[List[False, False], List[False, False]]],
Rule[FrameLabel, List[List[None, None], List[None, None]]],
Rule[FrameTicks, List[List[Automatic, Automatic], List[Automatic, Automatic]]],
Rule[GridLines, List[None, None]],
Rule[GridLinesStyle, Directive[GrayLevel[0.5`, 0.4`]]],
Rule[Method, List[Rule["CoordinatesToolOptions",
  List[Rule["DisplayFunction", Function[List[Function[Identity[Slot[1]]][
    Part[Slot[1], 1]], Function[Identity[Slot[1]]][Part[Slot[1], 2]]]],
  Rule["CopiedValueFunction", Function[List[Function[Identity[Slot[1]]][
    Part[Slot[1], 1]], Function[Identity[Slot[1]]][Part[Slot[1], 2]]]]]]],
Rule[PlotRange, List[List[0.`, 7.`, List[0, 4.`, ]]], Rule[PlotRangeClipping, True],
Rule[PlotRangePadding,
  List[List[Scaled[0.02`], Scaled[0.02`]], List[Scaled[0.02`], Scaled[0.05`]]]],
Rule[Ticks, List[Automatic, Automatic]]]]]
```

```
Graphics[List[List[], List[List[List[],
  List[Hue[1, 0, 0], Directive[PointSize[0.1], RGBColor[0.368417, 0.506779, 0.709798],
  AbsoluteThickness[1.6]], Point[List[List[1., 1.], List[2., 1.], List[3., 2.],
  List[4., 2.], List[5., 3.], List[6., 4.], List[7., 4.]]]], List[]],
  List[], List[], List[List[], List[]], List[List[], List[]]],
List[Rule[DisplayFunction, Identity], Rule[PlotRangePadding,
  List[List[Scaled[0.02], Scaled[0.02]], List[Scaled[0.02], Scaled[0.05]]]],
Rule[AxesOrigin, List[0., 0]], Rule[PlotRange, List[List[0., 7.], List[0, 4.]]],
Rule[PlotRangeClipping, True], Rule[ImagePadding, All],
Rule[DisplayFunction, Identity], Rule[AspectRatio, Power[GoldenRatio, -1]],
Rule[Axes, List[True, True]], Rule[AxesLabel, List[None, None]],
Rule[AxesOrigin, List[0., 0]], RuleDelayed[DisplayFunction, Identity],
Rule[Frame, List[List[False, False], List[False, False]]],
Rule[FrameLabel, List[List[None, None], List[None, None]]],
Rule[FrameTicks, List[List[Automatic, Automatic], List[Automatic, Automatic]]],
Rule[GridLines, List[None, None]],
Rule[GridLinesStyle, Directive[GrayLevel[0.5, 0.4]]],
Rule[Method, List[Rule["CoordinatesToolOptions",
  List[Rule["DisplayFunction", Function[List[Function[Identity[Slot[1]]][
  Part[Slot[1], 1], Function[Identity[Slot[1]]][Part[Slot[1], 2]]]],
  Rule["CopiedValueFunction", Function[List[Function[Identity[Slot[1]]][
  Part[Slot[1], 1], Function[Identity[Slot[1]]][Part[Slot[1], 2]]]]]]]],
Rule[PlotRange, List[List[0., 7.], List[0, 4.]]], Rule[PlotRangeClipping, True],
Rule[PlotRangePadding,
  List[List[Scaled[0.02], Scaled[0.02]], List[Scaled[0.02], Scaled[0.05]]]],
Rule[Ticks, List[Automatic, Automatic]]]]]
```



? ListPlot

ListPlot[{y₁, y₂, ...}] plots points {1, y₁}, {2, y₂}, ...

ListPlot[{{x₁, y₁}, {x₂, y₂}, ...}] plots a list of points with specified x and y coordinates.

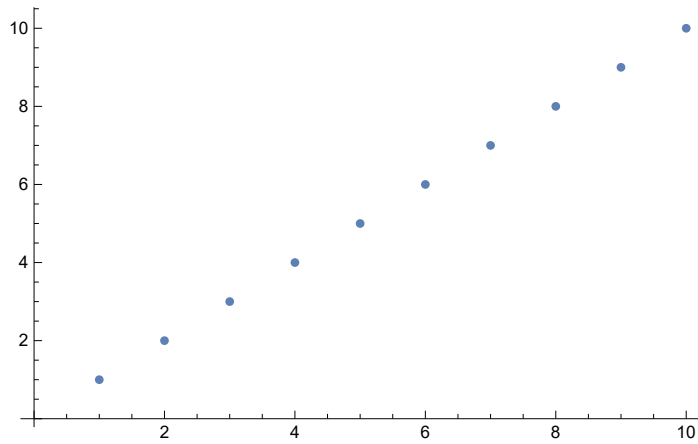
ListPlot[{data₁, data₂, ...}] plots data from all the data_i.

ListPlot[{..., w[data_i, ...], ...}] plots data_i with features defined by the symbolic wrapper w. >>

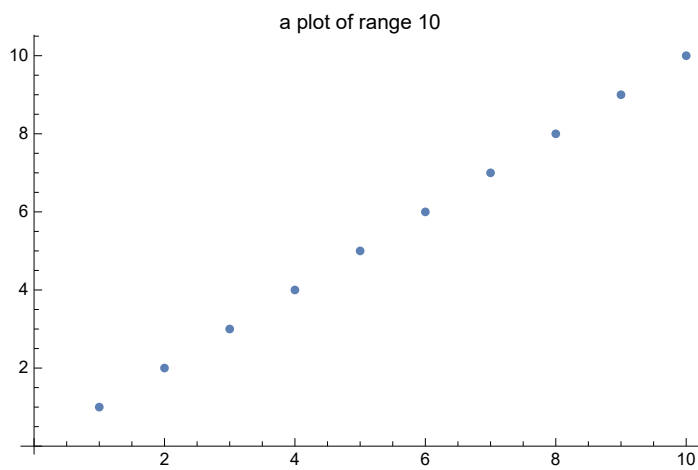
Range [10]

{1, 2, 3, 4, 5, 6, 7, 8, 9, 10}

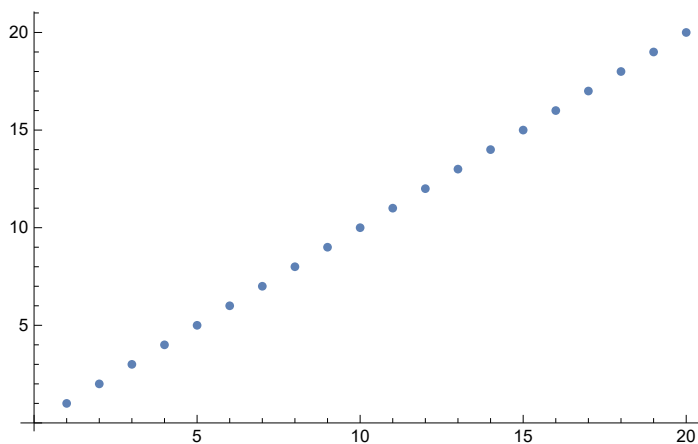
`ListPlot[Range[10]]`



`ListPlot[Range[10], PlotLabel -> "a plot of range 10"]`



`ListPlot[Range[20]]`



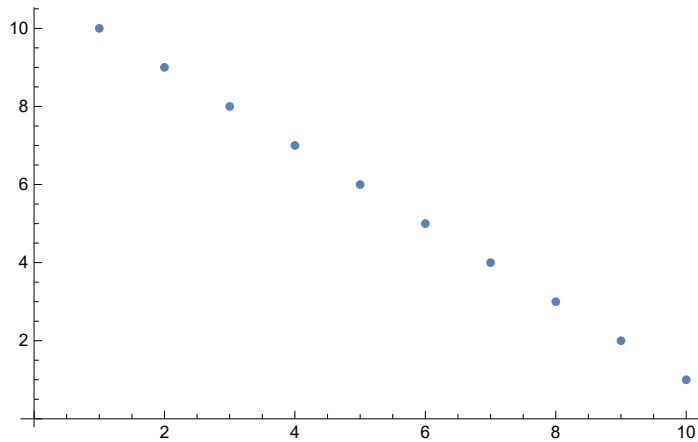
`Reverse[{1, 2, 3, 4}]`

`{4, 3, 2, 1}`

Reverse[Range[10]]

{10, 9, 8, 7, 6, 5, 4, 3, 2, 1}

ListPlot[Reverse[Range[10]]]



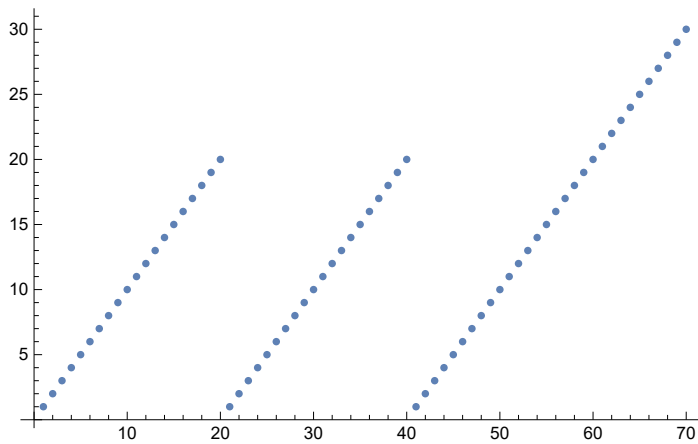
Join[f[1, 2], f[π , e], f[I, i, 7]]

f[1, 2, π , e, i, i, 7]

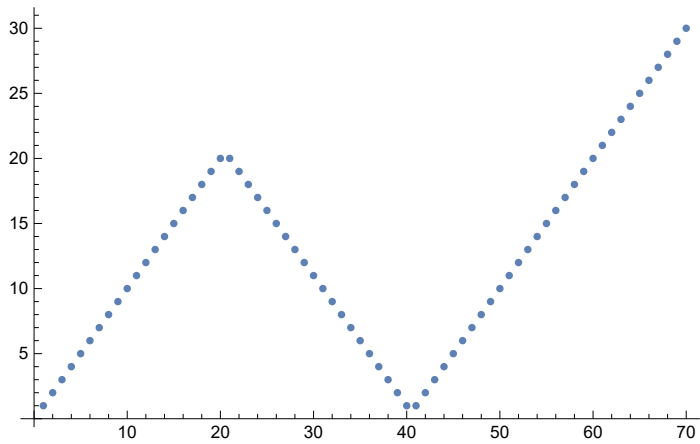
Join[{1, 2, 3}, {4, 5}, {6, 7}]

{1, 2, 3, 4, 5, 6, 7}

ListPlot[Join[Range[20], Range[20], Range[30]]]

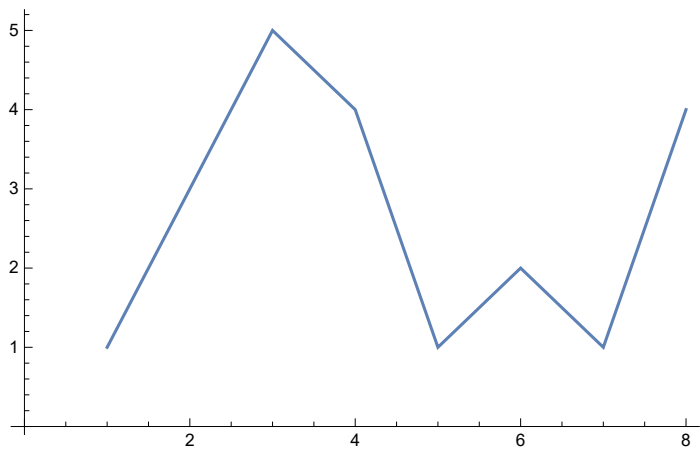


`ListPlot[Join[Range[20], Reverse[Range[20]], Range[30]]]`

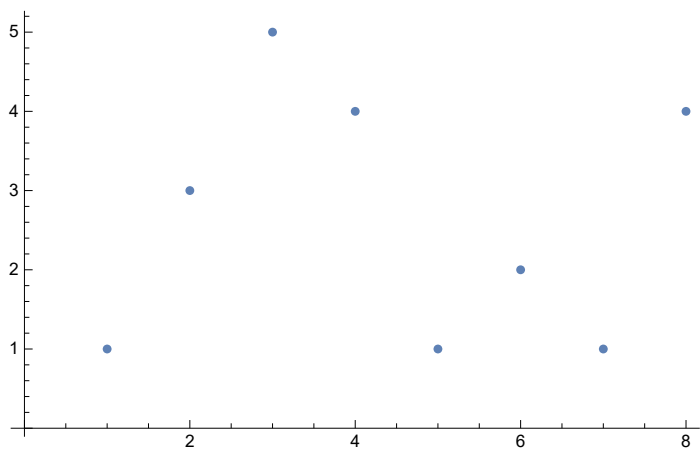


4. Displaying Lists

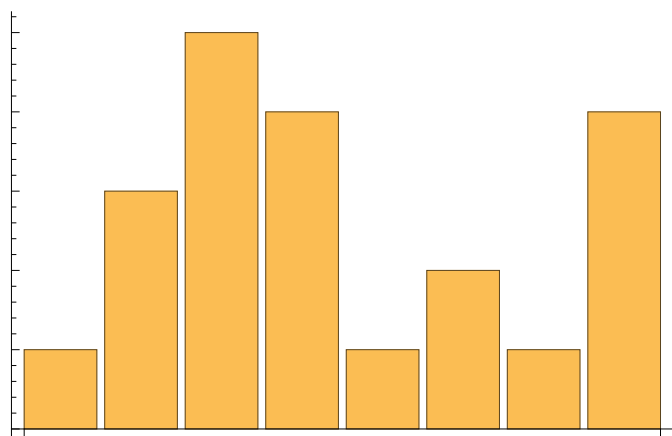
`ListLinePlot[{1, 3, 5, 4, 1, 2, 1, 4}]`



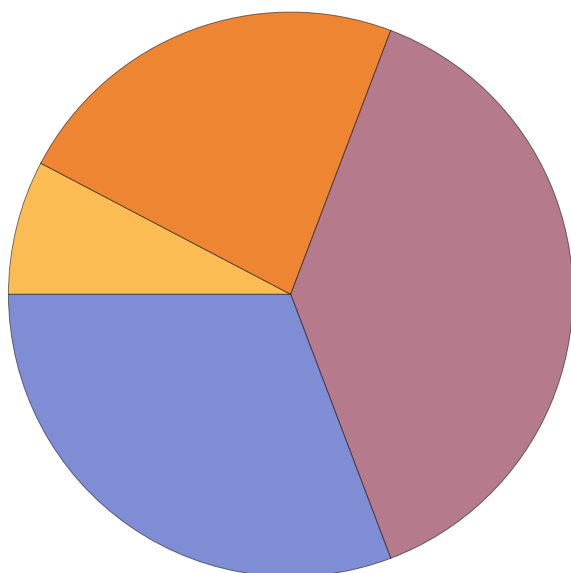
`ListPlot[{1, 3, 5, 4, 1, 2, 1, 4}]`



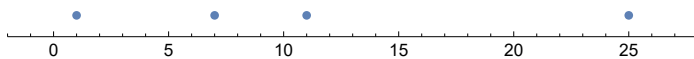
BarChart [{1, 3, 5, 4, 1, 2, 1, 4}]



PieChart [{1, 3, 5, 4}]



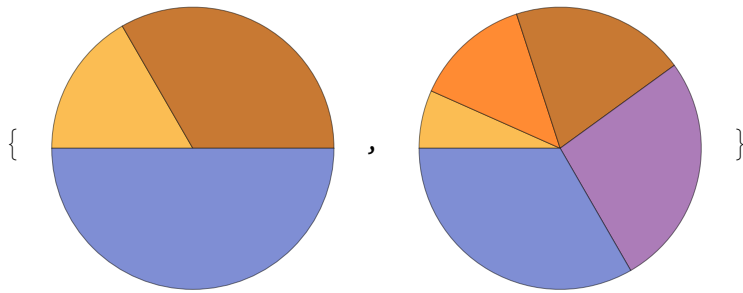
NumberLinePlot [{1, 7, 11, 25}]



Column [{100, 350, 502, 400}]

100
350
502
400

`{PieChart[Range[3]], PieChart[Range[5]]}`



`{BarChart[{1, 1, 4, 2}], BarChart[{5, 1, 1, 0}], BarChart[{1, 3, 2, 4}]}`

