Walker Problem Set 18

8/8

Due to getting a little behind in the final two weeks of the semester, I only checked for completeness on PS 18-21.
~Brian

Section 41

```
In[•]:= Cases[Table[IntegerDigits[n^2], {n, 99}], {___, x_, x_, ___}]
Out[•]=
{{1, 0, 0}, {1, 4, 4}, {2, 2, 5}, {4, 0, 0}, {4, 4, 1}, {9, 0, 0},
 {1, 1, 5, 6}, {1, 2, 2, 5}, {1, 4, 4, 4}, {1, 6, 0, 0}, {2, 1, 1, 6},
 {2, 2, 0, 9}, {2, 5, 0, 0}, {3, 3, 6, 4}, {3, 6, 0, 0}, {3, 8, 4, 4},
 {4, 2, 2, 5}, {4, 4, 8, 9}, {4, 9, 0, 0}, {5, 7, 7, 6}, {6, 4, 0, 0},
 {6, 8, 8, 9}, {7, 2, 2, 5}, {7, 7, 4, 4}, {8, 1, 0, 0}, {8, 8, 3, 6}}

In[•]:= StringJoin /@
 Cases[Array[Characters[RomanNumeral[#]] &, 100], {___, "L", ___, "I", ___, "X", ___}]
Out[•]=
{XLIX, LIX, LXIX, LXXIX, LXXXIX}

In[•]:= f[x] := x == Reverse[x]

In[•]:= Cases[Partition[TextWords[WikipediaData["alliteration"]], 2, 1],
 {a_, b_} /; Characters[a][[1]] == Characters[b][[1]]]
Out[•]=
{{or, of}, {as, a}, {Peter, Piper}, {pickled, peppers}, {Irish, It},
 {as, an}, {ideas, in}, {Icelandic, It}, {cartoon, characters}, {the, term},
 {identical, initial}, {several, special}, {as, alliteration}, {stressed, syllables},
 {as, an}, {lazy, languid}, {languid, line}, {as, alliteration}, {be, because},
 {such, syllables}, {syllables, start}, {consonant, clusters}, {sp, st},
 {consonant, clusters}, {s, sound}, {consonant, cluster}, {cluster, can},
 {with, words}, {consonant, cluster}, {s, such}, {sp, st}, {Walt, Whitman},
 {Splendid, Silent}, {Silent, Sun}, {consonant, clusters}, {sp, st},
 {spit, sting}, {stick, skin}, {consonant, clusters}, {s, seems}, {same, source},
 {consonant, clusters}, {to, the}, {the, two}, {identical, in}, {at, any},
 {home, hot}, {as, a}, {stressed, syllable}, {humble, house}, {potential, power},
```

{power, play}, {play, picture}, {picture, perfect}, {money, matters}, {rocky, road}, {quick, question}, {Peter, Piper}, {pickled, peppers}, {of, outside}, {same, sound}, {of, outside}, {to, the}, {brown, blazers}, {in, its}, {Poetry, Poets}, {can, call}, {splendid, silent}, {silent, sun}, {Walt, Whitman}, {Splendid, Silent}, {Silent, Sun}, {wondered, what}, {his, horse}, {also, add}, {to, the}, {harsh, hard}, {they, than}, {slippered, sleep}, {lean, lithe}, {fleet, flown}, {E., E.}, {heaped, heartbreak}, {fire, forthrightly}, {Chappell, Chestnuts}, {finally, finding}, {Finch, Fresh-firecoal}, {plotted, pieced}, {fold, fallow}, {height, hangs}, {hangs, his}, {who, wanders}, {barred, by}, {Who, Wanders}, {I, In}, {sat, silent}, {We, Were}, {swart, ship}, {with, weeping}, {out, onward}, {out, of}, {to, the}, {sun, sword}, {axe, angles}, {hell's, handiwork}, {silken, sad}, {breeze, blew}, {foam, flew}, {furrow, followed}, {followed, free}, {stood, still}, {churlish, chiding}, {winter's, wind}, {brown, below}, {harvests, hang}, {heavy, head}, {Brent, Bernard}, {who, watch}, {watch, with}, {with, wild}, {wild, wonder}, {wide, window}, {beautiful, birds}, {birds, begin}, {bountiful, birdseed}, {Thurston, Three}, {grey, geese}, {Grey, Geese}, {Betty, Botter}, {butter, but}, {she, said}, {butter's, bitter}, {it, in}, {make, my}, {batter, bitter}, {bitter, but}, {better, butter}, {make, my}, {bitter, batter}, {batter, better}, {the, tongue-twister}, {Betty, Botter}, {Peter, Piper}, {pickled, peppers}, {Peter, Piper}, {pickled, peppers}, {pickled, peppers}, {Peter, Piper}, {Helplessly, Hoping}, {throughout, the}, {stand, still}, {stood, still}, {Fairyland, Fanfare}, {legend, live}, {live, life}, {all, alone}, {to, the}, {lunar, lure}, {lacking, lustre}, {late, last}, {as, an}, {an, artistic}, {emotional, effect}, {any, attitude}, {is, in}, {as, an}, {which, we}, {our, only}, {of, our}, {our, own}, {but, by}, {today, that}, {that, the}, {truths, that}, {is, inextricably}, {to, the}, {itself, is}, {testimony, to}, {to, the}, {have, had}, {because, brave}, {freedom's, front}, {Ronald, Reagan}, {Vietnam, Veterans}, {new, nation}, {to, the}, {portae, proficiscere}, {blonde, bad-built}, {bad-built, butch}, {butch, body}, {and, adds}, {adds, an}, {an, alliteratiⅴe}, {Μάρθα, Μάρθα}, {Martha, Martha}, {Martha, Martha}, {House, Handbook}, {Modern, Memory}, {to, the}, {Some, Suggestive}, {4, 438}, {438, 45}, {E, E}, {55, 5}, {388, 390}, {Indolence, ISBN}, {R, R}, {alliteration, and}, {and, alliteratiⅴe}, {alliterations, and}}

In[•]:=
```
Grid[FixedPointList[
  (# /. {x___, b_, a_, y___} /; b > a → {x, a, b, y}) &, {4, 5, 1, 3, 2}], Frame → All]
```

Out[•]=

4	5	1	3	2
4	1	5	3	2
1	4	5	3	2
1	4	3	5	2
1	3	4	5	2
1	3	4	2	5
1	3	2	4	5
1	2	3	4	5
1	2	3	4	5

In[•]:=
```
Rotate[ArrayPlot[FixedPointList[(# /. {x___, b_, a_, y___} /; b > a → {x, a, b, y}) &,
    RandomSample[Range[50]]]], Pi / 2]
```

Out[•]=

In[•]:=
```
FixedPointList[(# + 2 / #) / 2 &, 1.0]
```

Out[•]=
```
{1., 1.5, 1.41667, 1.41422, 1.41421, 1.41421, 1.41421}
```

In[•]:=
```
FixedPointList[# /. {a_, b_} /; b ≠ 0 → {b, Mod[a, b]} &, {12 345, 54 321}]
```

Out[•]=
```
{{12 345, 54 321}, {54 321, 12 345}, {12 345, 4941},
 {4941, 2463}, {2463, 15}, {15, 3}, {3, 0}, {3, 0}}
```

In[•]:=
```
FixedPointList[
 # /. {s[x_][y_][z_] → x[z][y[z]], k[x_][y_] → x} &, s[s][k][s[s[s]][s]][s]]
```

Out[•]=
```
{s[s][k][s[s[s]][s]][s], s[s[s[s]][s]][k[s[s[s]][s]]][s],
 s[s[s]][s][s][k[s[s[s]][s]][s]], s[s][s][s[s]][s[s[s]][s]],
 s[s[s]][s[s[s]]][s[s[s]][s]], s[s][s[s[s]][s]][s[s[s]][s[s[s]][s]]],
 s[s[s[s]][s[s[s]][s]]][s[s[s]][s][s[s[s]][s[s[s]][s]]][s[s[s[s]][s[s[s]][s]]]],
 s[s[s[s]][s[s[s]][s]]][s[s][s[s[s]][s[s[s]][s]]][s[s[s[s]][s[s[s]][s]]]]],
 s[s[s[s]][s[s[s]][s]]][
  s[s[s[s[s]][s[s[s]][s]]]][s[s[s]][s[s[s]][s]][s[s[s[s]][s[s[s]][s]]]]],
 s[s[s[s]][s[s[s]][s]]][s[s[s[s[s]][s[s[s]][s]]]][s[s][s[s[s]][s[s[s]][s]]]][
    s[s[s]][s][s[s[s[s]][s[s[s]][s]]]]], s[s[s[s]][s[s[s]][s]]][
  s[s[s[s[s]][s[s[s]][s]]]][s[s[s[s]][s][s[s[s[s]][s[s[s]][s]]]]][
    s[s[s[s]][s[s[s]][s]]][s[s[s]][s][s[s[s[s]][s[s[s]][s]]]]]]]],
 s[s[s[s]][s[s[s]][s]]][s[s[s[s[s]][s[s[s]][s]]]][
   s[s[s][s[s[s[s]][s[s[s]][s]]]][s[s[s[s[s]][s[s[s]][s]]]]][s[s[s[s]][
       s[s[s]][s]]][s[s][s[s[s[s]][s[s[s]][s]]]][s[s[s[s[s]][s[s[s]][s]]]]]]]],
 s[s[s[s]][s[s[s]][s]]][s[s[s[s[s]][s[s[s]][s]]]][s[s[s[s[s]][s[s[s]][s]]]]][
    s[s[s[s]][s[s[s]][s]]][s[s[s[s[s]][s[s[s]][s]]]]][
      s[s[s[s]][s[s[s]][s]]][s[s[s[s[s]][s[s[s]][s]]]]]]],
 s[s[s[s]][s[s[s]][s]]][s[s[s[s[s]][s[s[s]][s]]]][s[s[s[s[s]][s[s[s]][s]]]]][
    s[s[s[s]][s[s[s]][s]]][s[s[s[s[s]][s[s[s]][s]]]]][
      s[s[s[s]][s[s[s]][s]]][s[s[s[s[s]][s[s[s]][s]]]]]]]}
```

In[•]:=
```
IntegerDigits[100!] /. {x___, 0 ..} → {x}
```

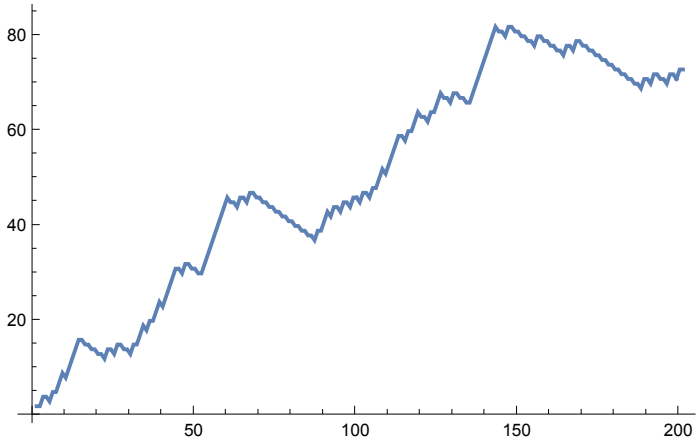
Out[•]=
```
{9, 3, 3, 2, 6, 2, 1, 5, 4, 4, 3, 9, 4, 4, 1, 5, 2, 6, 8, 1, 6, 9, 9, 2, 3, 8,
 8, 5, 6, 2, 6, 6, 7, 0, 0, 4, 9, 0, 7, 1, 5, 9, 6, 8, 2, 6, 4, 3, 8, 1, 6, 2, 1,
 4, 6, 8, 5, 9, 2, 9, 6, 3, 8, 9, 5, 2, 1, 7, 5, 9, 9, 9, 9, 3, 2, 2, 9, 9, 1, 5,
 6, 0, 8, 9, 4, 1, 4, 6, 3, 9, 7, 6, 1, 5, 6, 5, 1, 8, 2, 8, 6, 2, 5, 3, 6, 9, 7,
 9, 2, 0, 8, 2, 7, 2, 2, 3, 7, 5, 8, 2, 5, 1, 1, 8, 5, 2, 1, 0, 9, 1, 6, 8, 6, 4}
```

In[•]:=
```
Length /@
 NestList[# /. {{1, _, x___} → {x, 0, 1}, {0, _, x___} → {x, 1, 0, 0}} &, {1, 0}, 200]
```

Out[•]=
```
{2, 2, 3, 3, 4, 4, 5, 6, 6, 7, 8, 9, 9, 10, 11, 11, 12, 12, 13, 13, 14, 14, 15, 16, 16, 17,
 17, 18, 19, 19, 20, 21, 22, 22, 23, 23, 24, 24, 25, 25, 26, 26, 27, 28, 29, 29, 30,
 30, 31, 32, 32, 33, 33, 34, 35, 35, 36, 37, 37, 38, 38, 39, 40, 40, 41, 42, 43, 43,
 44, 44, 45, 45, 46, 46, 47, 47, 48, 48, 49, 50, 50, 51, 52, 53, 53, 54, 55, 55, 56,
 56, 57, 58, 58, 59, 59, 60, 61, 61, 62, 62, 63, 64, 64, 65, 66, 67, 67, 68, 69, 69,
 70, 70, 71, 71, 72, 72, 73, 74, 74, 75, 76, 77, 77, 78, 78, 79, 79, 80, 80, 81, 82,
 82, 83, 84, 85, 85, 86, 87, 87, 88, 88, 89, 89, 90, 90, 91, 92, 92, 93, 93, 94, 95,
 95, 96, 97, 98, 98, 99, 100, 100, 101, 101, 102, 103, 103, 104, 104, 105, 106,
 106, 107, 108, 109, 109, 110, 111, 111, 112, 112, 113, 113, 114, 114, 115, 116,
 116, 117, 117, 118, 119, 119, 120, 121, 122, 122, 123, 123, 124, 124, 125, 125}
```

In[•]:=
```
ListLinePlot[Length /@ NestList[# /. {{0, _, x___} → {x, 2, 1},
      {1, _, x___} → {x, 0}, {2, _, x___} → {x, 0, 2, 1, 2}} &, {0, 0}, 200]]
```

Out[•]=



Section 42

In[•]:=
```
StringReplace["1 2 3 4", WhitespaceCharacter → "---"]
```

Out[•]=
```
1---2---3---4
```

```
In[•]:= Sort[StringCases[WikipediaData["computers"],
          DigitCharacter ~~ DigitCharacter ~~ DigitCharacter ~~ DigitCharacter]]
```

```
Out[•]=
{1000, 1235, 1357, 1357, 1595, 1613, 1620, 1630, 1640, 1770, 1822, 1831, 1833,
 1835, 1872, 1872, 1876, 1876, 1888, 1890, 1897, 1901, 1901, 1906, 1914, 1920,
 1920, 1925, 1927, 1930, 1934, 1936, 1936, 1937, 1937, 1938, 1939, 1940, 1941,
 1941, 1942, 1943, 1943, 1943, 1943, 1944, 1945, 1945, 1945, 1945, 1945, 1945,
 1947, 1947, 1947, 1948, 1948, 1949, 1950, 1950, 1950, 1950, 1950, 1951,
 1951, 1952, 1953, 1953, 1955, 1955, 1955, 1955, 1957, 1958, 1958, 1959,
 1959, 1960, 1962, 1964, 1967, 1968, 1970, 1970, 1970, 1970, 1990, 1998,
 2000, 2000, 2000, 2016, 2400, 2468, 4000, 4004, 5000, 5100, 6502, 6510}
```

```
In[•]:= StringCases[WikipediaData["computers"], Shortest["===" ~~ x__ ~~ "==="] → x]
```

```
Out[•]=
{ Pre-20th century ,  First computer ,  Electromechanical calculating machine ,
  Analog computers ,  Digital computers , = Electromechanical ,
 = Vacuum tubes and digital electronic circuits ,  Modern computers ,
 = Concept of modern computer , = Stored programs , = Transistors ,
 = Integrated circuits ,  Mobile computers ,  By architecture ,
  By size, form-factor and purpose ,  History of computing hardware ,
  Other hardware topics ,  Input devices ,  Output devices ,  Control unit ,
  Central processing unit (CPU) ,  Arithmetic logic unit (ALU) ,  Memory ,
  Input/output (I/O) ,  Multitasking ,  Multiprocessing ,  Languages ,  Programs ,
 = Stored program architecture , = Machine code , = Programming language ,
 == Low-level languages , == High-level languages , = Program design ,
 = Bugs ,  Computer architecture paradigms ,  Artificial intelligence }
```

```
In[•]:= Grid[Table[StringTemplate["`1`+`2`=`3`"][i, j, i + j], {i, 9}, {j, 9}], Frame → All]
```

```
Out[•]=
```

1+1=2	1+2=3	1+3=4	1+4=5	1+5=6	1+6=7	1+7=8	1+8=9	1+9=10
2+1=3	2+2=4	2+3=5	2+4=6	2+5=7	2+6=8	2+7=9	2+8=10	2+9=11
3+1=4	3+2=5	3+3=6	3+4=7	3+5=8	3+6=9	3+7=10	3+8=11	3+9=12
4+1=5	4+2=6	4+3=7	4+4=8	4+5=9	4+6=10	4+7=11	4+8=12	4+9=13
5+1=6	5+2=7	5+3=8	5+4=9	5+5=10	5+6=11	5+7=12	5+8=13	5+9=14
6+1=7	6+2=8	6+3=9	6+4=10	6+5=11	6+6=12	6+7=13	6+8=14	6+9=15
7+1=8	7+2=9	7+3=10	7+4=11	7+5=12	7+6=13	7+7=14	7+8=15	7+9=16
8+1=9	8+2=10	8+3=11	8+4=12	8+5=13	8+6=14	8+7=15	8+8=16	8+9=17
9+1=10	9+2=11	9+3=12	9+4=13	9+5=14	9+6=15	9+7=16	9+8=17	9+9=18

```
In[•]:= Select[IntegerName /@ Range[50], StringMatchQ[#, ___ ~~ "i" ~~ ___ ~~ "e" ~~ ___] &]
```

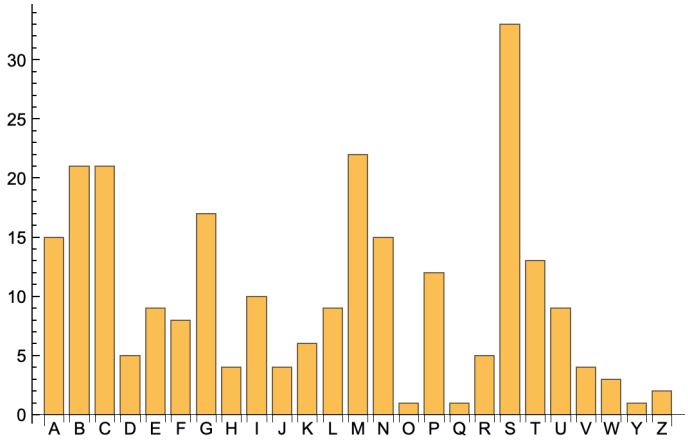
```
Out[•]=
{five, nine, thirteen, fifteen, sixteen, eighteen, nineteen,
 twenty-five, twenty-nine, thirty-one, thirty-three, thirty-five,
 thirty-seven, thirty-eight, thirty-nine, forty-five, forty-nine}
```

In[•]:=
```
StringReplace[First[TextSentences[WikipediaData["computers"]]], x;
 x : (Whitespace ~~ LetterCharacter ~~ LetterCharacter ~~ Whitespace) :> ToUpperCase[x]]
```

Out[•]=
```
A computer IS a machine that can BE programmed TO automatically
  carry out sequences OF arithmetic OR logical operations (computation).
```

In[•]:=
```
BarChart[KeySort[Counts[First /@ Characters /@ TextString /@ EntityList[
```
all countries, dependencies, and territories COUNTRIES
```
]]], ChartLabels → Automatic]
```

Out[•]=



In[•]:=
```
Grid[Table[StringTemplate["`1`^`2`=`3`"][i, j, i^j], {i, 5}, {j, 5}], Frame → All]
```

Out[•]=

1^1=1	1^2=1	1^3=1	1^4=1	1^5=1
2^1=2	2^2=4	2^3=8	2^4=16	2^5=32
3^1=3	3^2=9	3^3=27	3^4=81	3^5=243
4^1=4	4^2=16	4^3=64	4^4=256	4^5=1024
5^1=5	5^2=25	5^3=125	5^4=625	5^5=3125