Advent of Code 2021 - Day 14: Extended Polymerization

Parsing

```
input = "NNCB

CH→B
HH→N
CB→H
NH→C
HB→C
HC→B
HN→C
NN→C
BH→H
NC→B
NB→B
BN→B
BB→N
BC→B
CC→N
CN→C";

lines = StringSplit[input, "\n"]
```

{NNCB, , CH→B, HH→N, CB→H, NH→C, HB→C, HC→B, HN→C, NN→C, BH→H, NC→B, NB→B, BN→B,

polymertemplate = Characters@lines[[1]]

{N, N, C, B}

stringrules = lines[[3;;]]

{CH→B, HH→N, CB→H, NH→C, HB→C, HC→B, HN→C, NN→C, BH→H, NC→B, NB→B, BN→B, BB→N, I

rules = Map[(Characters@StringTake[#, 2] → {{StringTake[#, {1}], StringTake[#, {4}]}, {StringTake[#, {4}], S

{{B, B} → {{B, N}, {N, B}}, {B, C} → {{B, B}, {B, C}}, {B, H} → {{B, H}, {H, H}}, {B, N} →
{{B, B}, {B, N}}, {C, B} → {{C, H}, {H, B}}, {C, C} → {{C, N}, {N, C}}, {C, H} →
{{C, B}, {B, H}}, {C, N} → {{C, C}, {C, N}}, {H, B} → {{H, C}, {C, B}}, {H, C} →
{{H, B}, {B, C}}, {H, H} → {{H, N}, {N, H}}, {H, N} → {{H, C}, {C, N}}, {N, B} →
{{N, B}, {B, B}}, {N, C} → {{N, B}, {B, C}}, {N, H} → {{N, C}, {C, H}}, {N, N} →
{{N, C}, {C, N}}}

Create Matrix of Pair Insertion

intmapping = MapIndexed[#1 → First@#2&, rules[[All, 1]]]

{{B, B} → 1, {B, C} → 2, {B, H} → 3, {B, N} → 4, {C, B} → 5, {C, C} →
6, {C, H} → 7, {C, N} → 8, {H, B} → 9, {H, C} → 10, {H, H} → 11, {H, N} →
12, {N, B} → 13, {N, C} → 14, {N, H} → 15, {N, N} → 16}

{B, B} → {{B, N}, {N, B}}/.intmapping

1 → {4, 13}

transformations = Map[{{#[[2, 1]], #[[1]]}, {#[[2, 2]], #[[1]]}}&, rules]/.intmapping//Flatten[#, 1]&

{{4, 1}, {13, 1}, {1, 2}, {2, 2}, {3, 3}, {11, 3}, {1, 4}, {4, 4}, {7, 5}, {9, 5}, {8, 6}, {14, 6}, {5, 7}, {3, 7}, {6, 8}, {8, 8},

matrix = SparseArray[transformations → Table[1, Length@transformations], {Length@rules, Length@rules}]

SparseArray $\left[\square\right]$

MatrixForm[matrix]

$$\begin{pmatrix}
0 & 1 & 0 & 1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 & 0 \\
0 & 1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 & 0 & 1 & 0 & 0 \\
0 & 0 & 1 & 0 & 0 & 0 & 1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
1 & 0 & 0 & 1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 1 & 0 & 1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 & 0 \\
0 & 0 & 0 & 0 & 0 & 1 & 0 & 1 & 0 & 0 & 0 & 1 & 0 & 0 & 0 & 1 \\
0 & 0 & 0 & 0 & 1 & 0 & 0 & 0 & 0 & 1 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 & 1 & 0 & 0 & 0 & 0 \\
0 & 0 & 1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 & 0 & 0 & 0 \\
1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 & 1 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 & 1 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0
\end{pmatrix}$$

Initial Polymer

Rule@@#&/@(Tally@Partition[Characters[lines[[1]]], 2, 1]/.intmapping)

$\{16 \to 1, 14 \to 1, 5 \to 1\}$

init = Table[0, Length@rules]//ReplacePart[Rule@@#&/@(Tally@Partition[polymertemplate, 2, 1]/.intmappin

$\{0, 0, 0, 0, 1, 0, 0, 0, 0, 0, 0, 0, 0, 1, 0, 1\}$

Multiplication

resultingpairs = MatrixPower[matrix, 10, init] * rules[[All, 1]]

doubletotal = Total@Flatten@resultingpairs + First@polymertemplate + Last@polymertemplate

$\{\{812\text{B}, 812\text{B}\}, \{120\text{B}, 120\text{C}\}, \{81\text{B}, 81\text{H}\}, \{735\text{B}, 735\text{N}\}, \{115\text{C}, 115\text{B}\}, \{60\text{C}, 60\text{C}\}, \{21\text{C}, 21\text{H}\}, \{102\text{C}, 102\text{N}\},$

$3498\text{B} + 596\text{C} + 322\text{H} + 1730\text{N}$

#[[1]]/2&/@List@@doubletotal//MinMax//Differences//First

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