

LZW compression – Example

Text = A B A B A B B A B A A B B A B B A

dictionary: A:0 B:1
codeword length: 1

| step | position in string | longest string in dictionary | b | add to dictionary | code |
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LZW compression – Example

Text = A B A B A B B A B A A B B A B B A

dictionary: A:0 B:1
codeword length: 1

| step | position in string | longest string in dictionary | b | add to dictionary | code |
|------|--------------------|------------------------------|---|-------------------|------|
| 1 | 1 | A | 0 | | |
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LZW compression – Example

Text = A B A B A B B A B A A B B A B B A

dictionary: A:0 B:1
codeword length: 2

| step | position in string | longest string in dictionary | b | add to dictionary | code |
|------|--------------------|------------------------------|---|-------------------|------|
| 1 | 1 | A | 0 | | |
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LZW compression – Example

Text = A B A B A B B A B A A B B A B B A

dictionary: A:0 B:1 AB:2

codeword length: 2

| step | position in string | longest string in dictionary | b | add to dictionary | code |
|------|--------------------|------------------------------|---|-------------------|------|
| 1 | 1 | A | 0 | AB | 2 |
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LZW compression – Example

Text = A B A B A B B A B A A B B A B B A

dictionary: A:0 B:1 AB:2

codeword length: 2

| step | position in string | longest string in dictionary | b | add to dictionary | code |
|------|--------------------|------------------------------|----|-------------------|------|
| 1 | 1 | A | 0 | AB | 2 |
| 2 | 2 | B | 01 | | |
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LZW compression – Example

Text = A B A B A B A B A B A B A B A

dictionary: A:0 B:1 AB:2 BA:3
codeword length: 2

| step | position in string | longest string in dictionary | b | add to dictionary | code |
|------|--------------------|------------------------------|----|-------------------|------|
| 1 | 1 | A | 0 | AB | 2 |
| 2 | 2 | B | 01 | BA | 3 |
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LZW compression – Example

Text = A B A B A B B A B A A B B A B B A

dictionary: A:0 B:1 AB:2 BA:3
codeword length: 2

| step | position in string | longest string in dictionary | b | add to dictionary | code |
|------|--------------------|------------------------------|----|-------------------|------|
| 1 | 1 | A | 0 | AB | 2 |
| 2 | 2 | B | 01 | BA | 3 |
| 3 | 3 | AB | 10 | | |
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LZW compression – Example

Text = A B A B A B B A B A A B B A B B A

dictionary: A:0 B:1 AB:2 BA:3

codeword length: 3

| step | position in string | longest string in dictionary | b | add to dictionary | code |
|------|--------------------|------------------------------|----|-------------------|------|
| 1 | 1 | A | 0 | AB | 2 |
| 2 | 2 | B | 01 | BA | 3 |
| 3 | 3 | AB | 10 | | |
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LZW compression – Example

Text = A B A B **A** B B A B A A B B A B B A

dictionary: **A:0 B:1 AB:2 BA:3 ABA:4**
codeword length: **3**

| step | position in string | longest string in dictionary | b | add to dictionary | code |
|------|--------------------|------------------------------|----|-------------------|------|
| 1 | 1 | A | 0 | AB | 2 |
| 2 | 2 | B | 01 | BA | 3 |
| 3 | 3 | AB | 10 | ABA | 4 |
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LZW compression – Example

Text = A B A B A B B A B A A B B A B B A

dictionary: A:0 B:1 AB:2 BA:3 ABA:4
codeword length: 3

| step | position in string | longest string in dictionary | b | add to dictionary | code |
|------|--------------------|------------------------------|-----|-------------------|------|
| 1 | 1 | A | 0 | AB | 2 |
| 2 | 2 | B | 01 | BA | 3 |
| 3 | 3 | AB | 10 | ABA | 4 |
| 4 | 5 | AB | 010 | | |
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LZW compression – Example

Text = A B A B A B **B** A B A A B B A B B A

dictionary: **A:0 B:1 AB:2 BA:3 ABA:4 ABB:5**
codeword length: **3**

| step | position in string | longest string in dictionary | b | add to dictionary | code |
|------|--------------------|------------------------------|-----|-------------------|------|
| 1 | 1 | A | 0 | AB | 2 |
| 2 | 2 | B | 01 | BA | 3 |
| 3 | 3 | AB | 10 | ABA | 4 |
| 4 | 5 | AB | 010 | ABB | 5 |
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LZW compression – Example

Text = A B A B A B **B A** B A A B B A B B A

dictionary: **A:0 B:1 AB:2 BA:3 ABA:4 ABB:5**
codeword length: **3**

| step | position in string | longest string in dictionary | b | add to dictionary | code |
|------|--------------------|------------------------------|-----|-------------------|------|
| 1 | 1 | A | 0 | AB | 2 |
| 2 | 2 | B | 01 | BA | 3 |
| 3 | 3 | AB | 10 | ABA | 4 |
| 4 | 5 | AB | 010 | ABB | 5 |
| 5 | 7 | BA | 011 | | |
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LZW compression – Example

Text = A B A B A B B A **B** A A B B A B B A

dictionary: **A:0 B:1 AB:2 BA:3 ABA:4 ABB: BAB:65**
codeword length: **3**

| step | position in string | longest string in dictionary | b | add to dictionary | code |
|------|--------------------|------------------------------|-----|-------------------|------|
| 1 | 1 | A | 0 | AB | 2 |
| 2 | 2 | B | 01 | BA | 3 |
| 3 | 3 | AB | 10 | ABA | 4 |
| 4 | 5 | AB | 010 | ABB | 5 |
| 5 | 7 | BA | 011 | BAB | 6 |
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LZW compression – Example

Text = A B A B A B B A **B A** A B B A B B A

dictionary: **A:0 B:1 AB:2 BA:3 ABA:4 ABB:5**
codeword length: **3**

| step | position in string | longest string in dictionary | b | add to dictionary | code |
|------|--------------------|------------------------------|-----|-------------------|------|
| 1 | 1 | A | 0 | AB | 2 |
| 2 | 2 | B | 01 | BA | 3 |
| 3 | 3 | AB | 10 | ABA | 4 |
| 4 | 5 | AB | 010 | ABB | 5 |
| 5 | 7 | BA | 011 | BAB | 6 |
| 6 | 9 | BA | 011 | | |
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LZW compression – Example

Text = A B A B A B B A B A **A** B B A B B A

dictionary: **A:0 B:1 AB:2 BA:3 ABA:4 ABB:5 BAA:7**
codeword length: **3**

| step | position in string | longest string in dictionary | b | add to dictionary | code |
|------|--------------------|------------------------------|-----|-------------------|------|
| 1 | 1 | A | 0 | AB | 2 |
| 2 | 2 | B | 01 | BA | 3 |
| 3 | 3 | AB | 10 | ABA | 4 |
| 4 | 5 | AB | 010 | ABB | 5 |
| 5 | 7 | BA | 011 | BAB | 6 |
| 6 | 9 | BA | 011 | BAA | 7 |
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LZW compression – Example

Text = A B A B A B B A B A A B B A B B A

dictionary: A:0 B:1 AB:2 BA:3 ABA:4 ABB:5 BAA:7
codeword length: 4

| step | position in string | longest string in dictionary | b | add to dictionary | code |
|------|--------------------|------------------------------|-----|-------------------|------|
| 1 | 1 | A | 0 | AB | 2 |
| 2 | 2 | B | 01 | BA | 3 |
| 3 | 3 | AB | 10 | ABA | 4 |
| 4 | 5 | AB | 010 | ABB | 5 |
| 5 | 7 | BA | 011 | BAB | 6 |
| 6 | 9 | BA | 011 | BAA | 7 |
| 7 | 11 | ABB | 100 | | |
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LZW compression – Example

Text = A B A B A B B A B A A B B A B B A

dictionary: A:0 B:1 AB:2 BA:3 ABA:4 ABB:5 BAA:7 ABBA:8
codeword length: 4

| step | position in string | longest string in dictionary | b | add to dictionary | code |
|------|--------------------|------------------------------|-----|-------------------|------|
| 1 | 1 | A | 0 | AB | 2 |
| 2 | 2 | B | 01 | BA | 3 |
| 3 | 3 | AB | 10 | ABA | 4 |
| 4 | 5 | AB | 010 | ABB | 5 |
| 5 | 7 | BA | 011 | BAB | 6 |
| 6 | 9 | BA | 011 | BAA | 7 |
| 7 | 11 | ABB | 100 | ABBA | 8 |
| | | | | | |

LZW compression – Example

Text = A B A B A B B A B A A B B A B B A

dictionary: A:0 B:1 AB:2 BA:3 ABA:4 ABB:5 BAA:7 ABBA:8
codeword length: 4

| step | position in string | longest string in dictionary | b | add to dictionary | code |
|------|--------------------|------------------------------|------|-------------------|------|
| 1 | 1 | A | 0 | AB | 2 |
| 2 | 2 | B | 01 | BA | 3 |
| 3 | 3 | AB | 10 | ABA | 4 |
| 4 | 5 | AB | 010 | ABB | 5 |
| 5 | 7 | BA | 011 | BAB | 6 |
| 6 | 9 | BA | 011 | BAA | 7 |
| 7 | 11 | ABB | 101 | ABBA | 8 |
| 8 | 14 | ABBA | 1000 | | |

LZW compression – Example

Text = A B A B A B B A B A A B B A B B A

compressed file = 001100100110111011000

dictionary: A:0 B:1 AB:2 BA:3 ABA:4 ABB:5 BAA:7 ABBA:8
codeword length: 4

| step | position in string | longest string in dictionary | b | add to dictionary | code |
|------|--------------------|------------------------------|------|-------------------|------|
| 1 | 1 | A | 0 | AB | 2 |
| 2 | 2 | B | 01 | BA | 3 |
| 3 | 3 | AB | 10 | ABA | 4 |
| 4 | 5 | AB | 010 | ABB | 5 |
| 5 | 7 | BA | 011 | BAB | 6 |
| 6 | 9 | BA | 011 | BAA | 7 |
| 7 | 11 | ABB | 101 | ABBA | 8 |
| 8 | 14 | ABBA | 1000 | – | – |

LZW decompression – Example

compressed file = 001100100110111011000

dictionary: A:0 B:1
codeword length: 1

| step | position in file | old string | code from dictionary | string | add to dictionary | code |
|------|---------------------|---------------|-------------------------|--------|----------------------|------|
| 0 | 1 | - | 0 | A | | |
| | | | | | | |
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LZW decompression – Example

compressed file = 001100100110111011000

dictionary: A:0 B:1
codeword length: 1

| step | position in file | old string | code from dictionary | string | add to dictionary | code |
|------|---------------------|---------------|-------------------------|--------|----------------------|------|
| 0 | 1 | - | 0 | A | - | - |
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LZW decompression – Example

compressed file = 001100100110111011000

dictionary: A:0 B:1
codeword length: 2

| step | position in file | old string | code from dictionary | string | add to dictionary | code |
|------|---------------------|---------------|-------------------------|--------|----------------------|------|
| 0 | 1 | - | 0 | A | - | - |
| 1 | 2 | | | | | |
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LZW decompression – Example

compressed file = 001100100110111011000

dictionary: A:0 B:1
codeword length: 2

| step | position in file | old string | code from dictionary | string | add to dictionary | code |
|------|---------------------|---------------|-------------------------|--------|----------------------|------|
| 0 | 1 | - | 0 | A | - | - |
| 1 | 2 | A | 01 | B | | |
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LZW decompression – Example

compressed file = 001100100110111011000

dictionary: A:0 B:1 AB:2
codeword length: 2

| step | position in file | old string | code from dictionary | string | add to dictionary | code |
|------|---------------------|---------------|-------------------------|--------|----------------------|------|
| 0 | 1 | - | 0 | A | - | - |
| 1 | 2 | A | 01 | B | AB | 2 |
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LZW decompression – Example

compressed file = 001100100110111011000

dictionary: A:0 B:1 AB:2

codeword length: 2

| step | position in file | old string | code from dictionary | string | add to dictionary | code |
|------|---------------------|---------------|-------------------------|--------|----------------------|------|
| 0 | 1 | - | 0 | A | - | - |
| 1 | 2 | A | 01 | B | AB | 2 |
| 2 | | | | | | |
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LZW decompression – Example

compressed file = 001**1**00100110111011000

dictionary: **A:0 B:1 AB:2**

codeword length: **2**

| step | position in file | old string | code from dictionary | string | add to dictionary | code |
|------|---------------------|---------------|-------------------------|--------|----------------------|------|
| 0 | 1 | - | 0 | A | - | - |
| 1 | 2 | A | 01 | B | AB | 2 |
| 2 | 4 | B | 10 | AB | | |
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LZW decompression – Example

compressed file = 001100100110111011000

dictionary: A:0 B:1 AB:2 BA:3
codeword length: 2

| step | position in file | old string | code from dictionary | string | add to dictionary | code |
|------|---------------------|---------------|-------------------------|--------|----------------------|------|
| 0 | 1 | - | 0 | A | - | - |
| 1 | 2 | A | 01 | B | AB | 2 |
| 2 | 4 | B | 10 | AB | BA | 3 |
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LZW decompression – Example

compressed file = 001100100110111011000

dictionary: A:0 B:1 AB:2 BA:3

codeword length: 3

| step | position in file | old string | code from dictionary | string | add to dictionary | code |
|------|---------------------|---------------|-------------------------|--------|----------------------|------|
| 0 | 1 | - | 0 | A | - | - |
| 1 | 2 | A | 01 | B | AB | 2 |
| 2 | 4 | B | 10 | AB | BA | 3 |
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LZW decompression – Example

compressed file = 00110**010**0110111011000

dictionary: **A:0 B:1 AB:2 BA:3**

codeword length: **3**

| step | position in file | old string | code from dictionary | string | add to dictionary | code |
|------|---------------------|---------------|-------------------------|--------|----------------------|------|
| 0 | 1 | - | 0 | A | - | - |
| 1 | 2 | A | 01 | B | AB | 2 |
| 2 | 4 | B | 10 | AB | BA | 3 |
| 3 | 6 | AB | 010 | AB | | |
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LZW decompression – Example

compressed file = 00110**010**0110111011000

dictionary: **A:0 B:1 AB:2 BA:3 ABA:4**
codeword length: **3**

| step | position in file | old string | code from dictionary | string | add to dictionary | code |
|------|---------------------|---------------|-------------------------|--------|----------------------|------|
| 0 | 1 | - | 0 | A | - | - |
| 1 | 2 | A | 01 | B | AB | 2 |
| 2 | 4 | B | 10 | AB | BA | 3 |
| 3 | 6 | AB | 010 | AB | ABA | 4 |
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LZW decompression – Example

compressed file = 001100100110111011000

dictionary: A:0 B:1 AB:2 BA:3 ABA:4
codeword length: 3

| step | position in file | old string | code from dictionary | string | add to dictionary | code |
|------|---------------------|---------------|-------------------------|--------|----------------------|------|
| 0 | 1 | - | 0 | A | - | - |
| 1 | 2 | A | 01 | B | AB | 2 |
| 2 | 4 | B | 10 | AB | BA | 3 |
| 3 | 6 | AB | 010 | AB | ABA | 4 |
| 4 | 9 | AB | 011 | BA | | |
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LZW decompression – Example

compressed file = 001100100110111011000

dictionary: A:0 B:1 AB:2 BA:3 ABA:4 ABB:5
codeword length: 3

| step | position in file | old string | code from dictionary | string | add to dictionary | code |
|------|---------------------|---------------|-------------------------|--------|----------------------|------|
| 0 | 1 | - | 0 | A | - | - |
| 1 | 2 | A | 01 | B | AB | 2 |
| 2 | 4 | B | 10 | AB | BA | 3 |
| 3 | 6 | AB | 010 | AB | ABA | 4 |
| 4 | 9 | AB | 011 | BA | ABB | 5 |
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LZW decompression – Example

compressed file = 001100100110111011000

dictionary: A:0 B:1 AB:2 BA:3 ABA:4 ABB:5 BAB:6
codeword length: 3

| step | position in file | old string | code from dictionary | string | add to dictionary | code |
|------|---------------------|---------------|-------------------------|--------|----------------------|------|
| 0 | 1 | - | 0 | A | - | - |
| 1 | 2 | A | 01 | B | AB | 2 |
| 2 | 4 | B | 10 | AB | BA | 3 |
| 3 | 6 | AB | 010 | AB | ABA | 4 |
| 4 | 9 | AB | 011 | BA | ABB | 5 |
| 5 | 12 | BA | 011 | BA | BAB | 6 |
| | | | | | | |
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LZW decompression – Example

compressed file = 001100100110111011000

dictionary: A:0 B:1 AB:2 BA:3 ABA:4 ABB:5 BAB:6 BAA:7
codeword length: 3

| step | position in file | old string | code from dictionary | string | add to dictionary | code |
|------|---------------------|---------------|-------------------------|--------|----------------------|------|
| 0 | 1 | - | 0 | A | - | - |
| 1 | 2 | A | 01 | B | AB | 2 |
| 2 | 4 | B | 10 | AB | BA | 3 |
| 3 | 6 | AB | 010 | AB | ABA | 4 |
| 4 | 9 | AB | 011 | BA | ABB | 5 |
| 5 | 12 | BA | 011 | BA | BAB | 6 |
| 6 | 15 | BA | 101 | ABB | BAA | 7 |
| | | | | | | |

LZW decompression – Example

compressed file = 001100100110111011000

dictionary: A:0 B:1 AB:2 BA:3 ABA:4 ABB:5 BAB:6 BAA:7
codeword length: 4

| step | position in file | old string | code from dictionary | string | add to dictionary | code |
|------|---------------------|---------------|-------------------------|--------|----------------------|------|
| 0 | 1 | - | 0 | A | - | - |
| 1 | 2 | A | 01 | B | AB | 2 |
| 2 | 4 | B | 10 | AB | BA | 3 |
| 3 | 6 | AB | 010 | AB | ABA | 4 |
| 4 | 9 | AB | 011 | BA | ABB | 5 |
| 5 | 12 | BA | 011 | BA | BAB | 6 |
| 6 | 15 | BA | 101 | ABB | BAA | 7 |
| | | | | | | |

LZW decompression – Example

compressed file = 001100100110111011000

dictionary: A:0 B:1 AB:2 BA:3 ABA:4 ABB:5 BAB:6 BAA:7
codeword length: 3

| step | position in file | old string | code from dictionary | string | add to dictionary | code |
|------|---------------------|---------------|-------------------------|--------|----------------------|------|
| 0 | 1 | - | 0 | A | - | - |
| 1 | 2 | A | 01 | B | AB | 2 |
| 2 | 4 | B | 10 | AB | BA | 3 |
| 3 | 6 | AB | 010 | AB | ABA | 4 |
| 4 | 9 | AB | 011 | BA | ABB | 5 |
| 5 | 12 | BA | 011 | BA | BAB | 6 |
| 6 | 15 | BA | 101 | ABB | BAA | 7 |
| 7 | 18 | ABB | 1000 | | | |

LZW decompression – Special case

It is possible to encounter a codeword that is not (yet) in the dictionary

- because decompression is ‘out of phase’ with compression
- but in that case it is possible to deduce what string it must represent

The solution: `if (lookUp fails) s = oldS + oldS.charAt(0);`

LZW decompression – Example

compressed file = 001100100110111011000

dictionary: A:0 B:1 AB:2 BA:3 ABA:4 ABB:5 BAB:6 BAA:7
codeword length: 3

| step | position in file | old string | code from dictionary | string | add to dictionary | code |
|------|---------------------|---------------|-------------------------|--------|----------------------|------|
| 0 | 1 | - | 0 | A | - | - |
| 1 | 2 | A | 01 | B | AB | 2 |
| 2 | 4 | B | 10 | AB | BA | 3 |
| 3 | 6 | AB | 010 | AB | ABA | 4 |
| 4 | 9 | AB | 011 | BA | ABB | 5 |
| 5 | 12 | BA | 011 | BA | BAB | 6 |
| 6 | 15 | BA | 101 | ABB | BAA | 7 |
| 7 | 18 | ABB | 1000 | | | |

LZW decompression – Example

compressed file = 001100100110111011000

dictionary: A:0 B:1 AB:2 BA:3 ABA:4 ABB:5 BAB:6 BAA:7
codeword length: 3

| step | position in file | old string | code from dictionary | string | add to dictionary | code |
|------|---------------------|---------------|-------------------------|--------|----------------------|------|
| 0 | 1 | - | 0 | A | - | - |
| 1 | 2 | A | 01 | B | AB | 2 |
| 2 | 4 | B | 10 | AB | BA | 3 |
| 3 | 6 | AB | 010 | AB | ABA | 4 |
| 4 | 9 | AB | 011 | BA | ABB | 5 |
| 5 | 12 | BA | 011 | BA | BAB | 6 |
| 6 | 15 | BA | 101 | ABB | BAA | 7 |
| 7 | 18 | ABB | 1000 | ABBA | | |

LZW decompression – Example

compressed file = 001100100110111011000

dictionary: A:0 B:1 AB:2 BA:3 ABA:4 ABB:5 BAB:6 BAA:7
codeword length: 3

| step | position in file | old string | code from dictionary | string | add to dictionary | code |
|------|---------------------|---------------|-------------------------|--------|----------------------|------|
| 0 | 1 | - | 0 | A | - | - |
| 1 | 2 | A | 01 | B | AB | 2 |
| 2 | 4 | B | 10 | AB | BA | 3 |
| 3 | 6 | AB | 010 | AB | ABA | 4 |
| 4 | 9 | AB | 011 | BA | ABB | 5 |
| 5 | 12 | BA | 011 | BA | BAB | 6 |
| 6 | 15 | BA | 101 | ABB | BAA | 7 |
| 7 | 18 | ABB | 1000 | ABBA | ABBA | 8 |

LZW decompression – Example

compressed file = 001100100110111011000

dictionary: A:0 B:1 AB:2 BA:3 ABA:4 ABB:5 BAB:6 BAA:7
codeword length: 3

| step | position in file | old string | code from dictionary | string | add to dictionary | code |
|------|---------------------|---------------|-------------------------|--------|----------------------|------|
| 0 | 1 | - | 0 | A | - | - |
| 1 | 2 | A | 01 | B | AB | 2 |
| 2 | 4 | B | 10 | AB | BA | 3 |
| 3 | 6 | AB | 010 | AB | ABA | 4 |
| 4 | 9 | AB | 011 | BA | ABB | 5 |
| 5 | 12 | BA | 011 | BA | BAB | 6 |
| 6 | 15 | BA | 101 | ABB | BAA | 7 |
| 7 | 18 | ABB | 1000 | ABBA | ABBA | 8 |