CS 243 — Discrete Math and Functional Programming

Huffman encoding

Dec 9, 2015

Fom *Discrete Mathematics and Functional Programming* by Thomas VanDrunen; example and code originally adapted from *Structure and Interpretation of Computer Programs* by Abelson and Sussman.

Encoding

ASCII/Unicode (last four bits):

A	0001	F	0110	K	1011
B	0010	G	0111	L	1100
C	0011	H	1000	M	1101
D	0100	I	1001	N	1110
E	0101	J	1010	O	1111

Sample encoding:

0001	1110	1110	1001	1011	0001
A	N	N	I	K	A

Message size: $4 \times 6 = 24$ bits.

Encoding

Variable-length codes (frequent letters are shorter):

A	0	F	100	K	01
B	10	G	101	L	0000
C	001	H	110	M	11
D	010	I	00	N	1
E	011	J	111	O	0001

Sample encoding:

0	1	1	00	01	0
A	N	N	I	K	A

Message size: $1 + 1 + 1 + 2 + 2 + 1 = 8$ bits.

Encoding

A	0	F	100	K	01
B	10	G	101	L	0000
C	001	H	110	M	11
D	010	I	00	N	1
E	011	J	111	O	0001

0	1	1	00	01	0
A	N	N	I	K	A

Or did you mean

011	0001	0
E	O	A

Encoding

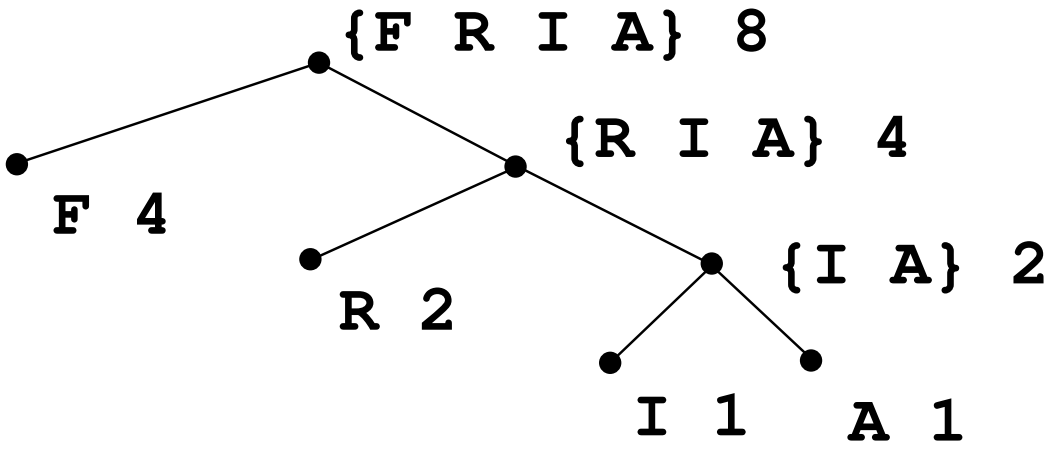
Prefix code

A	0	F	...	K	111
B	...	G	...	L	...
C	...	H	...	M	...
D	...	I	110	N	10
E	...	J	...	O	...

0	10	10	110	111	0
A	N	N	I	K	A

Message size: $1 + 2 + 2 + 3 + 3 + 1 = 12$ bits.

Trees



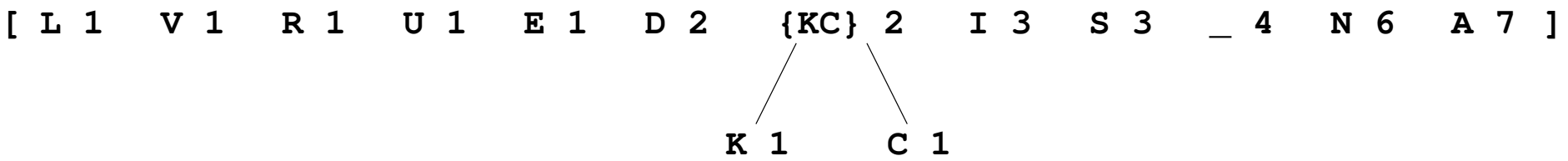
RIFFRAFF

A	111
F	0
I	110
R	10

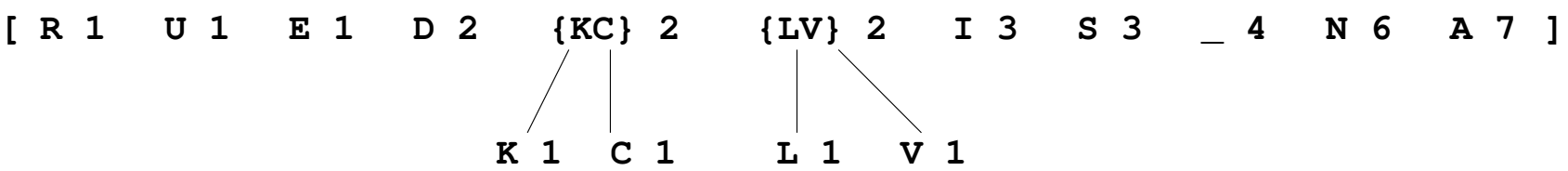
Building the tree

[K 1 C 1 L 1 V 1 R 1 U 1 E 1 D 2 I 3 S 3 _ 4 N 6 A 7]

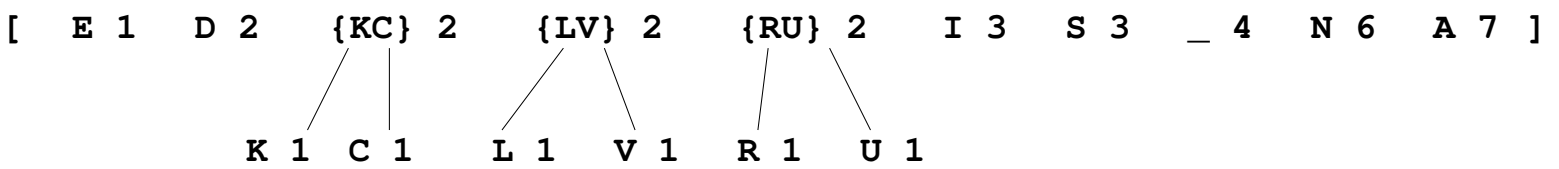
Building the tree



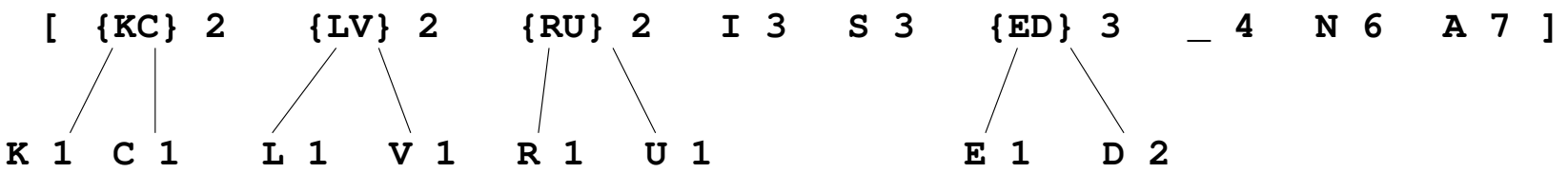
Building the tree



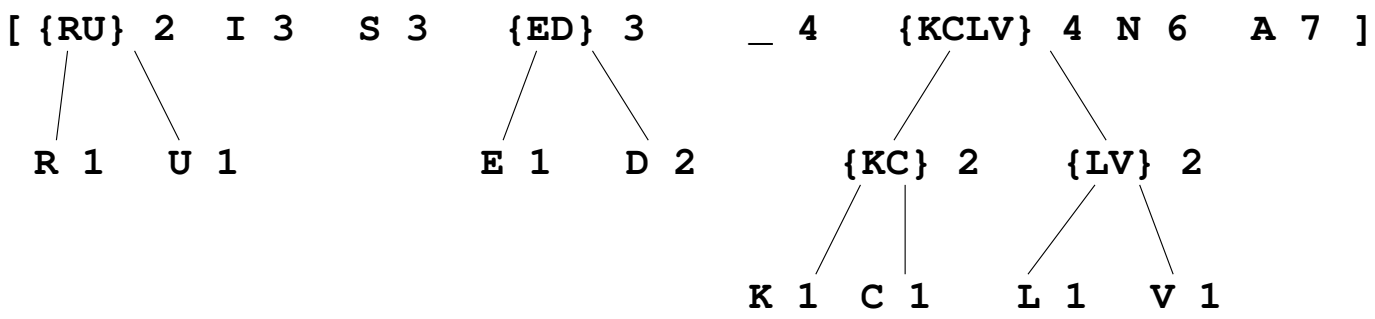
Building the tree



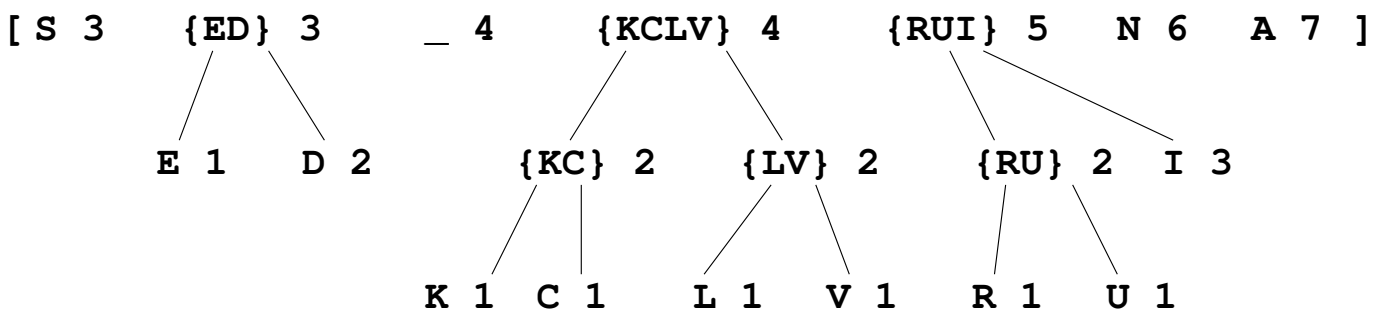
Building the tree



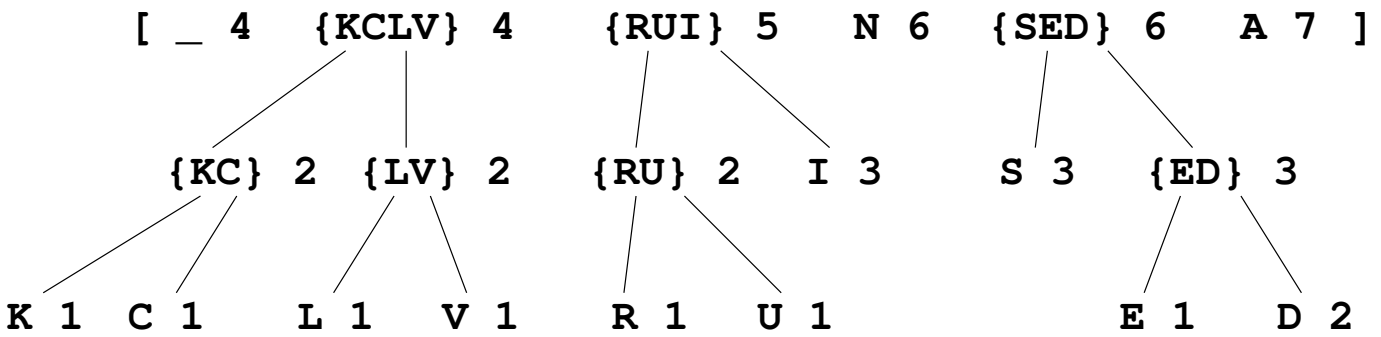
Building the tree



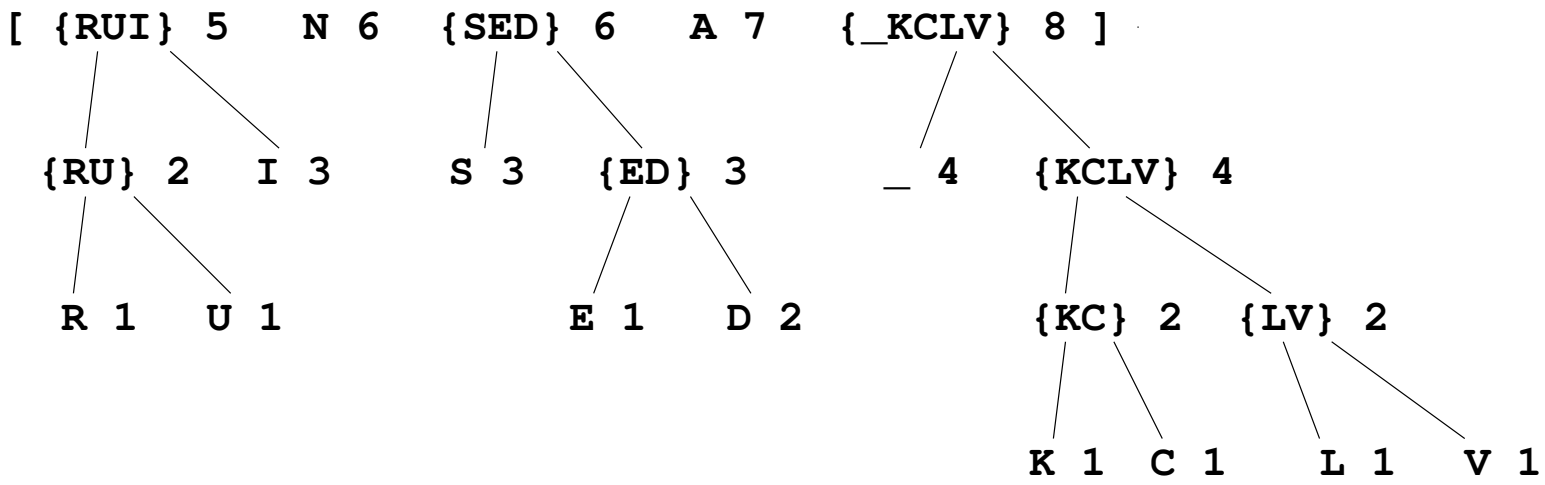
Building the tree



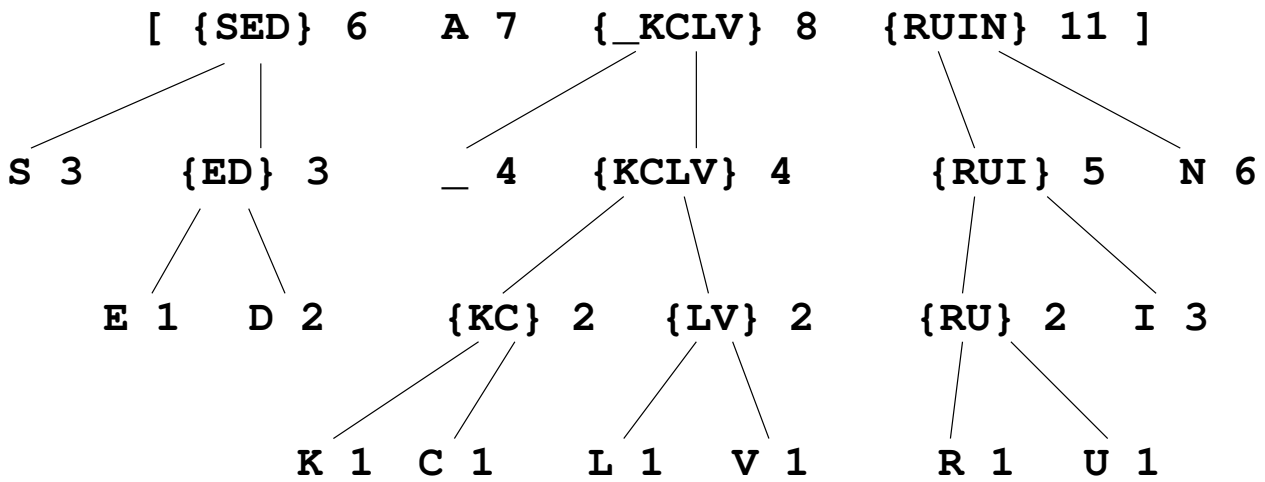
Building the tree



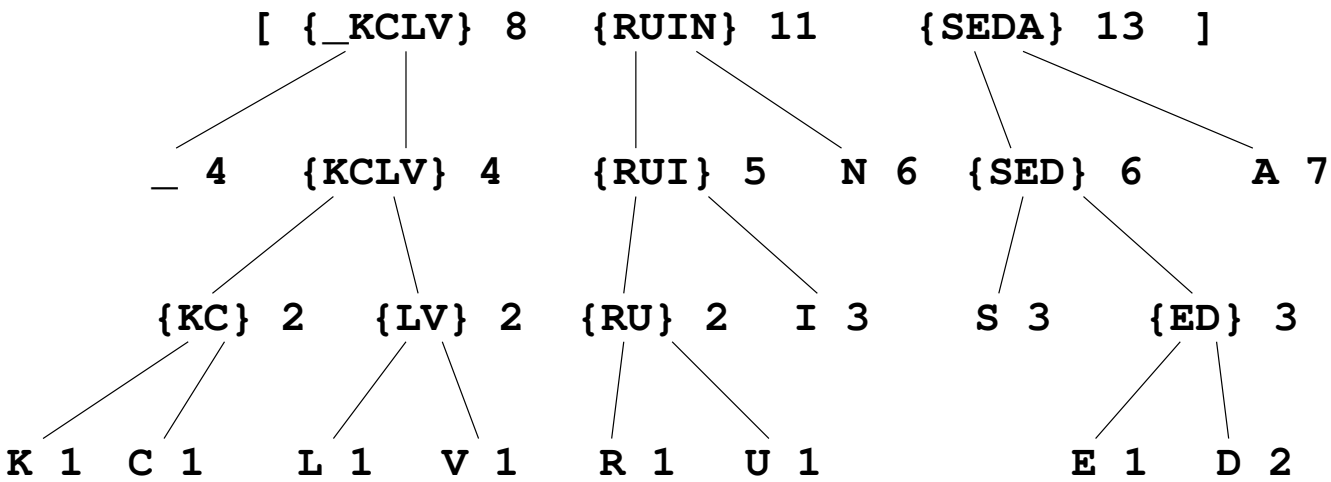
Building the tree



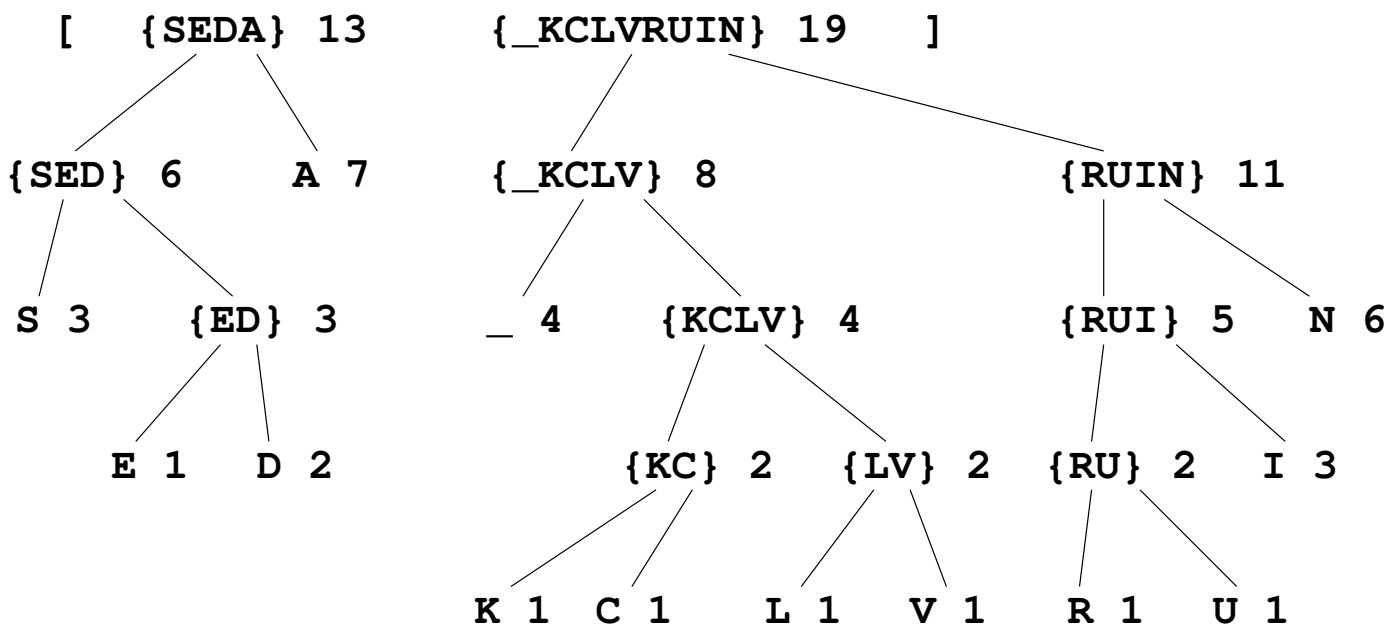
Building the tree



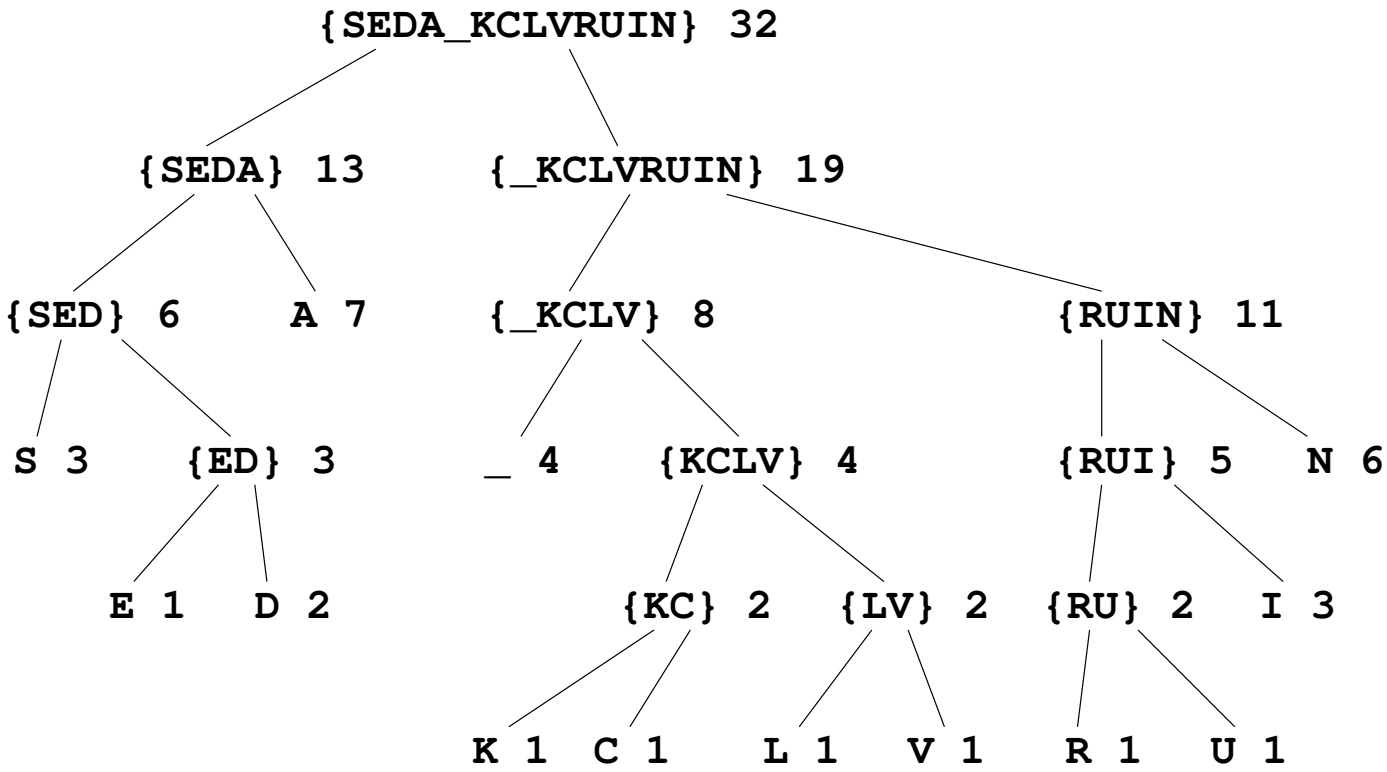
Building the tree



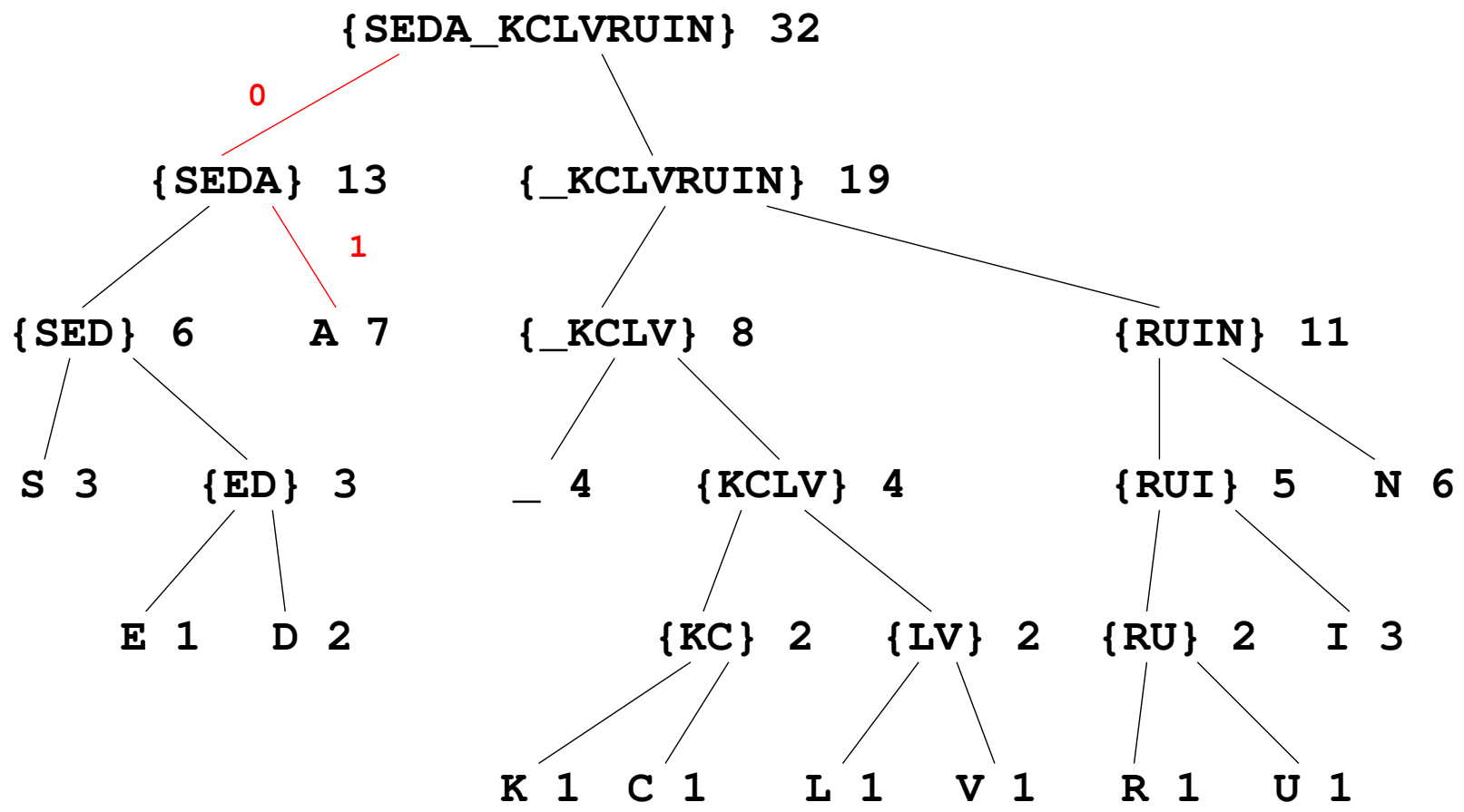
Building the tree



Building the tree

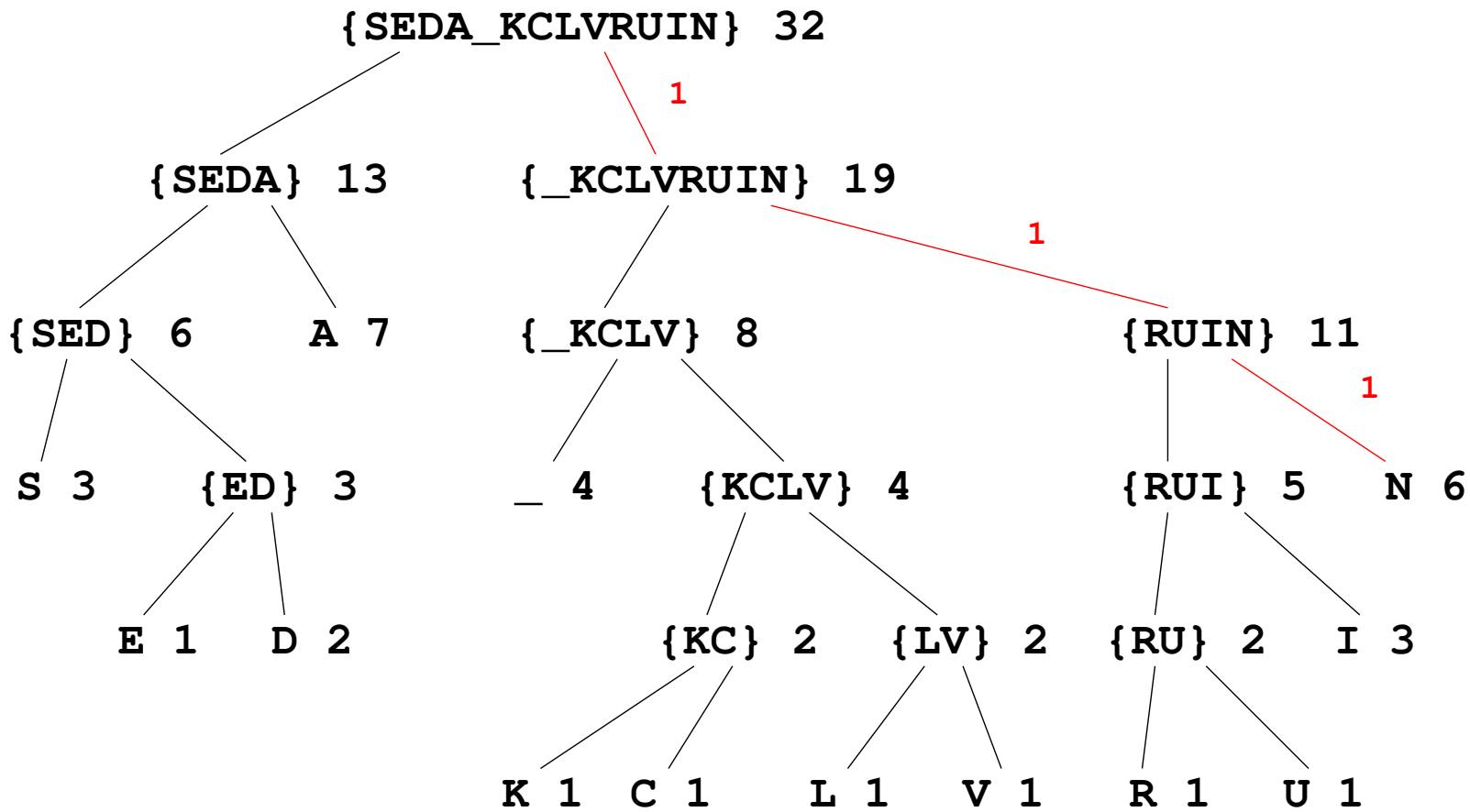


Encoding the message



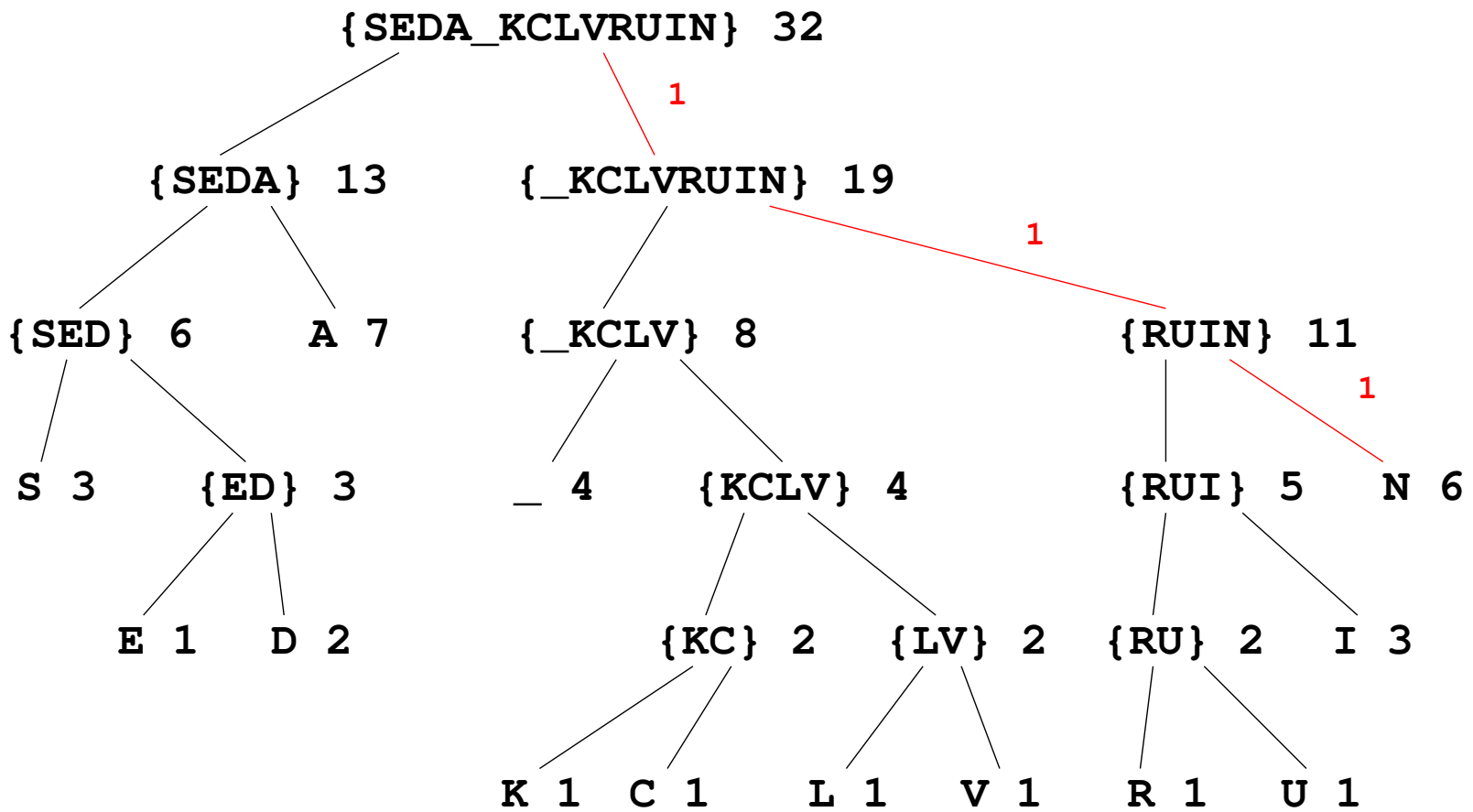
01
A

Encoding the message



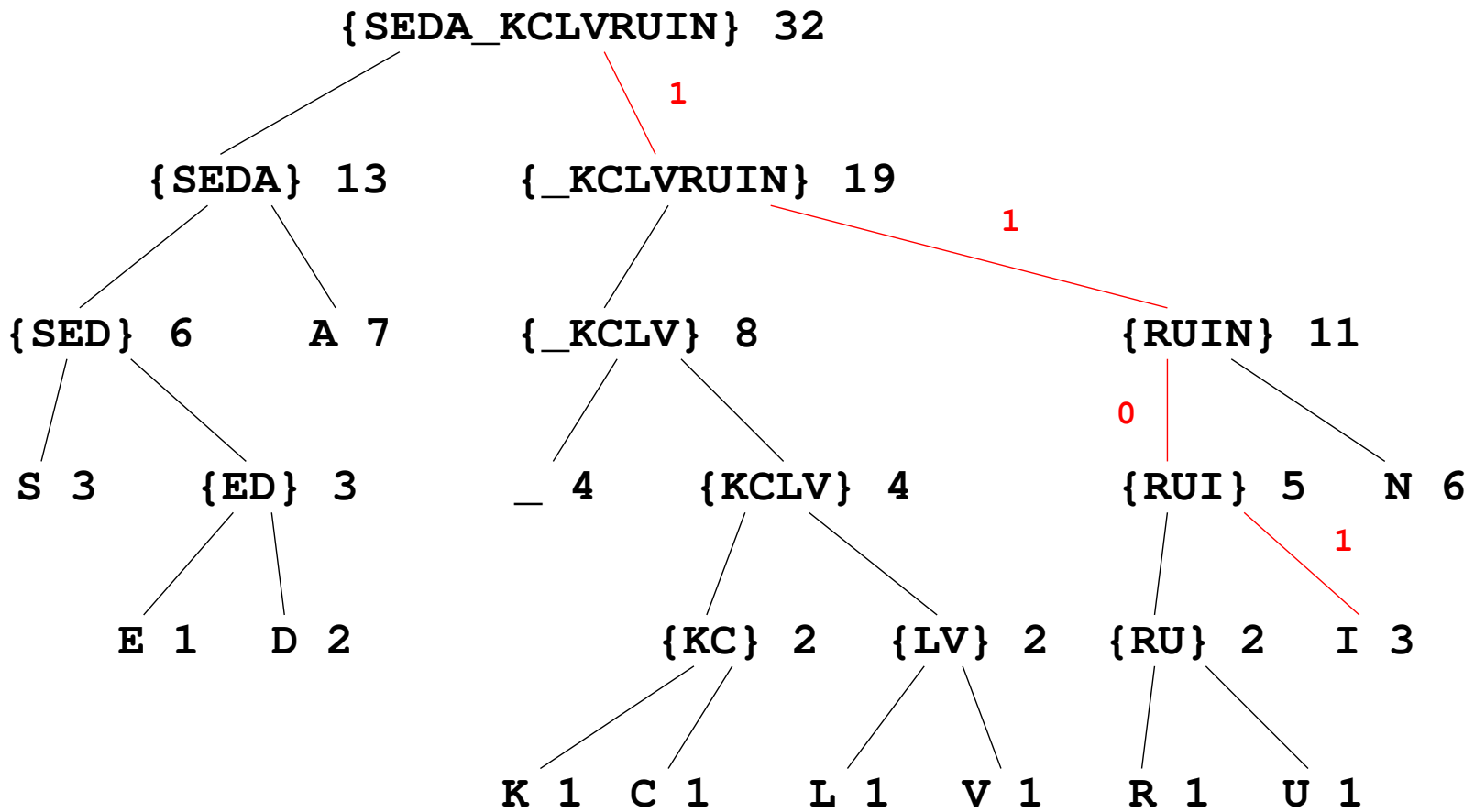
01	111
A	N

Encoding the message



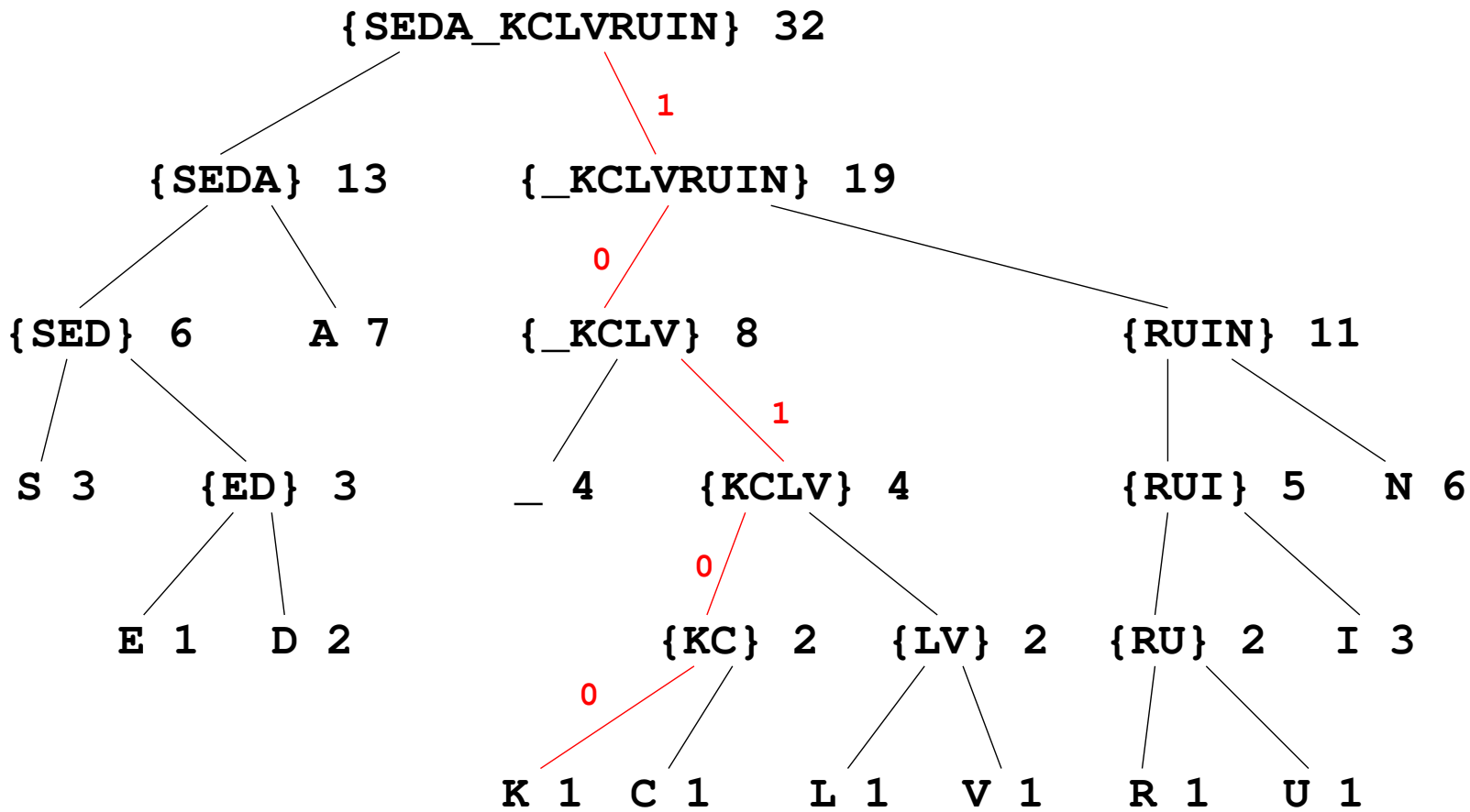
01	111	111
A	N	N

Encoding the message



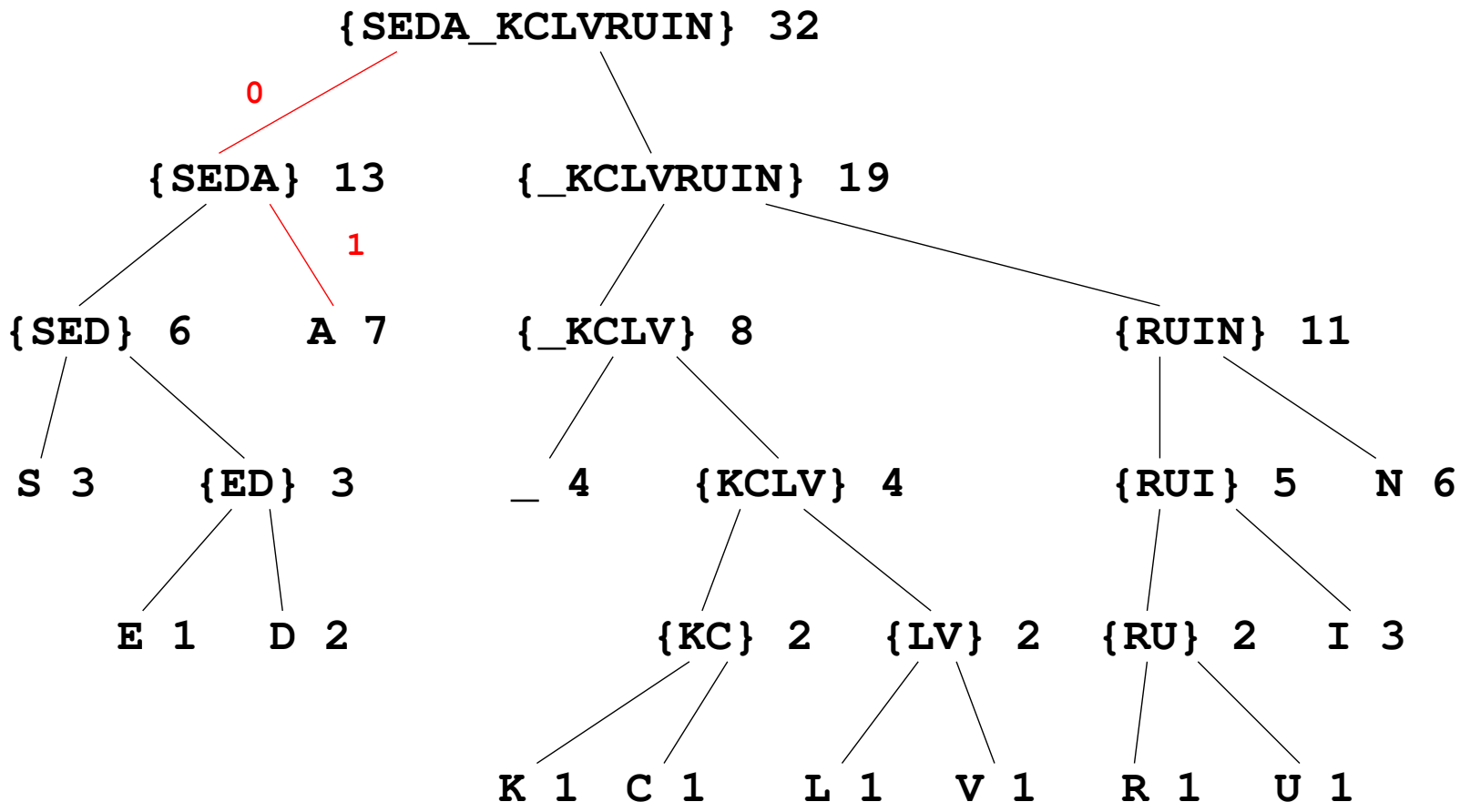
01	111	111	1101
A	N	N	I

Encoding the message



01	111	111	1101	10100
A	N	N	I	K

Encoding the message



01	111	111	1101	10100	01
A	N	N	I	K	A