DiSparse6: a handy way for computers to remember digraphs

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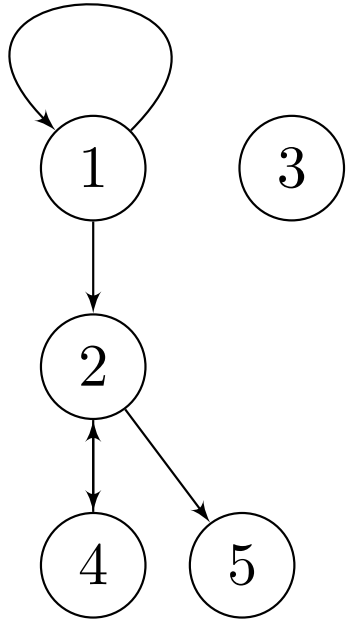
Representing digraphs

How do we represent this digraph?



Edge set: $\{(1,1),(1,2),(2,4),(2,5),(4,2)\}$

The adjacencies/edge-set approach: *DiSparse6*

- Edge set: $\{(1,1),(1,2),(2,4),(2,5),(4,2)\}$
- $(2,4)\ (1,1)\ (1,2)\ (2,4)\ (2,5)$
- $(1,3)\ (0,0)\ (0,1)\ (1,3)\ (1,4)$
- 1 **3** 0 **1** 1 **5** 0 **0** 1 **0** 1 **3** 0 **1** 1 **1**
- 1 **011** 0 **001** 1 **101** 0 **000** 1 **000** 1 **011** 0 **001** 1 **001**
- `101100 011101 000010 001011 000110 011111`
- `  44 29 02 11 06 31`
- `107 92 65 74 69 94`
- `  k  \  A  J  E  ^`
- `.Dk\AJE^` (9 characters)

How to convert edges to *DiSparse6*

Start with $v := 0$
Consider the next pair (a, b) in the list.
while there are still pairs left **do**
    We want $v = b$.
    if $v = b$ **then**
        Print bit 0
    else if $v < b$ **then**
        Print bit 1
        Increment v by 1
    end if
    if $v < b$ (still!) **then**
        Print b
        Set $v := b$
    else if $v = b$ **then**
        Print a
        Move onto the next pair (a, b)
    end if
    (When you finish the decreasing edges, print 1 n and reset $v := 0$)
end while

ASCII table

63	?
64	@
65	A
66	B
67	C
68	D
69	E
70	F
71	G
72	H
73	I
74	J
75	K
76	L
77	M
78	N

79	O
80	P
81	Q
82	R
83	S
84	T
85	U
86	V
87	W
88	X
89	Y
90	Z
91	[
92	\
93	]
94	^

95	_
96	‘
97	a
98	b
99	c
100	d
101	e
102	f
103	g
104	h
105	i
106	j
107	k
108	l
109	m
110	n

111	o
112	p
113	q
114	r
115	s
116	t
117	u
118	v
119	w
120	x
121	y
122	z
123	{
124	|
125	}
126	~

How long is a *DiSparse6* string?

- $\sim \frac{3}{2} e(\lceil \log_2 v \rceil + 1)$ bits
- $\sim \frac{1}{4} e(\lceil \log_2 v \rceil + 1)$ characters