

A2 - due 2 weeks from tomorrow
- relatively short → regular expressions

CSC148 fall 2013

linked structures

week 7

Danny Heap

heap@cs.toronto.edu

BA4270 (behind elevators)

<http://www.cdf.toronto.edu/~heap/148/F13/>

416-978-5899

October 22, 2013

Outline

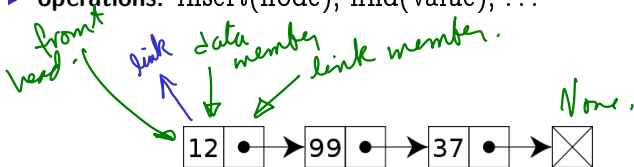
linked lists, conceptually

$[[1, 2], [3, 4]]$

- ▶ **data:** Sequence of nodes, each with a value and reference to next (successor) node. List has reference to front (aka head) node).

retain this.

- ▶ **operations:** insert(node), find(value), ...



a node class

```
class LListNode:
    '''Linked List node that can reference next node.'''

    def __init__(self, value=None, nxt=None):
        '''Create a LListNode with value and reference to next LListNode'''

        self.value, self.nxt = value, nxt

    def __repr__(self):
        '''Represent this node as a string.'''

        return 'LListNode(' + str(self.value) + ', ' + str(self.nxt) + ')'
```

default values.

de string

tuple unpacking.



prefer repr to str

Two special methods for representing an object. If you omit `__str__`, Python will use `__repr__`. By convention, the latter should be able to produce an equivalent object.

where possible



an alternative Stack

Use `LListNode` to re-implement `Stack`, and compare performance.

histogram for test #1

	q1	q2	q3	t1
out of	10.0	15.0	15.0	45.0
average%	74.9	69.9	69.6	71.5
excl.dr.	74.9	69.9	69.6	71.5
>=100%	84	34	11	22
90.. <lt;100%< td=""><td>1</td><td>26</td><td>11</td><td>26</td></lt;100%<>	1	26	11	26
80.. <lt;90%< td=""><td>5</td><td>50</td><td>58</td><td>26</td></lt;90%<>	5	50	58	26
70.. <lt;80%< td=""><td>13</td><td>12</td><td>35</td><td>36</td></lt;80%<>	13	12	35	36
60.. <lt;70%< td=""><td>17</td><td>30</td><td>43</td><td>34</td></lt;70%<>	17	30	43	34
50.. <lt;60%< td=""><td>12</td><td>5</td><td>16</td><td>34</td></lt;60%<>	12	5	16	34
40.. <lt;50%< td=""><td>35</td><td>14</td><td>17</td><td>15</td></lt;50%<>	35	14	17	15
35.. <lt;40%< td=""><td>8</td><td>0</td><td>3</td><td>4</td></lt;40%<>	8	0	3	4
30.. <lt;35%< td=""><td>14</td><td>7</td><td>4</td><td>6</td></lt;35%<>	14	7	4	6
20.. <lt;30%< td=""><td>16</td><td>16</td><td>8</td><td>3</td></lt;30%<>	16	16	8	3
10.. <lt;20%< td=""><td>0</td><td>3</td><td>0</td><td>0</td></lt;20%<>	0	3	0	0
1.. <lt;10%< td=""><td>0</td><td>3</td><td>0</td><td>0</td></lt;10%<>	0	3	0	0
< 1%	1	6	0	0

took out of 10, so some got > 100
father than out



histogram for test #1

	q1	q2	q3	t1
out of	10.0	15.0	15.0	45.0
average%	74.9	69.9	69.6	71.5
excl.dr.	74.9	69.9	69.6	71.5
>=100%	84	34	11	22
90.. <lt;100%< td=""><td>1</td><td>26</td><td>11</td><td>26</td></lt;100%<>	1	26	11	26
80.. <lt;90%< td=""><td>5</td><td>50</td><td>58</td><td>26</td></lt;90%<>	5	50	58	26
70.. <lt;80%< td=""><td>13</td><td>12</td><td>35</td><td>36</td></lt;80%<>	13	12	35	36
60.. <lt;70%< td=""><td>17</td><td>30</td><td>43</td><td>34</td></lt;70%<>	17	30	43	34
50.. <lt;60%< td=""><td>12</td><td>5</td><td>16</td><td>34</td></lt;60%<>	12	5	16	34
40.. <lt;50%< td=""><td>35</td><td>14</td><td>17</td><td>15</td></lt;50%<>	35	14	17	15
35.. <lt;40%< td=""><td>8</td><td>0</td><td>3</td><td>4</td></lt;40%<>	8	0	3	4
30.. <lt;35%< td=""><td>14</td><td>7</td><td>4</td><td>6</td></lt;35%<>	14	7	4	6
20.. <lt;30%< td=""><td>16</td><td>16</td><td>8</td><td>3</td></lt;30%<>	16	16	8	3
10.. <lt;20%< td=""><td>0</td><td>3</td><td>0</td><td>0</td></lt;20%<>	0	3	0	0
1.. <lt;10%< td=""><td>0</td><td>3</td><td>0</td><td>0</td></lt;10%<>	0	3	0	0
< 1%	1	6	0	0

histogram for test #1

	q1	q2	q3	t1
out of	10.0	15.0	15.0	45.0
average%	74.9	69.9	69.6	71.5
excl.dr.	74.9	69.9	69.6	71.5
>=100%	84	34	11	22
90.. <lt;100%< td=""><td>1</td><td>26</td><td>11</td><td>26</td></lt;100%<>	1	26	11	26
80.. <lt;90%< td=""><td>5</td><td>50</td><td>58</td><td>26</td></lt;90%<>	5	50	58	26
70.. <lt;80%< td=""><td>13</td><td>12</td><td>35</td><td>36</td></lt;80%<>	13	12	35	36
60.. <lt;70%< td=""><td>17</td><td>30</td><td>43</td><td>34</td></lt;70%<>	17	30	43	34
50.. <lt;60%< td=""><td>12</td><td>5</td><td>16</td><td>34</td></lt;60%<>	12	5	16	34
40.. <lt;50%< td=""><td>35</td><td>14</td><td>17</td><td>15</td></lt;50%<>	35	14	17	15
35.. <lt;40%< td=""><td>8</td><td>0</td><td>3</td><td>4</td></lt;40%<>	8	0	3	4
30.. <lt;35%< td=""><td>14</td><td>7</td><td>4</td><td>6</td></lt;35%<>	14	7	4	6
20.. <lt;30%< td=""><td>16</td><td>16</td><td>8</td><td>3</td></lt;30%<>	16	16	8	3
10.. <lt;20%< td=""><td>0</td><td>3</td><td>0</td><td>0</td></lt;20%<>	0	3	0	0
1.. <lt;10%< td=""><td>0</td><td>3</td><td>0</td><td>0</td></lt;10%<>	0	3	0	0
< 1%	1	6	0	0

histogram for test #1

	q1	q2	q3	t1
out of	10.0	15.0	15.0	45.0
average%	74.9	69.9	69.6	71.5
excl.dr.	74.9	69.9	69.6	71.5
>=100%	84	34	11	22
90.. <lt;100%< td=""><td>1</td><td>26</td><td>11</td><td>26</td></lt;100%<>	1	26	11	26
80.. <lt;90%< td=""><td>5</td><td>50</td><td>58</td><td>26</td></lt;90%<>	5	50	58	26
70.. <lt;80%< td=""><td>13</td><td>12</td><td>35</td><td>36</td></lt;80%<>	13	12	35	36
60.. <lt;70%< td=""><td>17</td><td>30</td><td>43</td><td>34</td></lt;70%<>	17	30	43	34
50.. <lt;60%< td=""><td>12</td><td>5</td><td>16</td><td>34</td></lt;60%<>	12	5	16	34
40.. <lt;50%< td=""><td>35</td><td>14</td><td>17</td><td>15</td></lt;50%<>	35	14	17	15
35.. <lt;40%< td=""><td>8</td><td>0</td><td>3</td><td>4</td></lt;40%<>	8	0	3	4
30.. <lt;35%< td=""><td>14</td><td>7</td><td>4</td><td>6</td></lt;35%<>	14	7	4	6
20.. <lt;30%< td=""><td>16</td><td>16</td><td>8</td><td>3</td></lt;30%<>	16	16	8	3
10.. <lt;20%< td=""><td>0</td><td>3</td><td>0</td><td>0</td></lt;20%<>	0	3	0	0
1.. <lt;10%< td=""><td>0</td><td>3</td><td>0</td><td>0</td></lt;10%<>	0	3	0	0
< 1%	1	6	0	0

histogram for test #1

	q1	q2	q3	t1
out of	10.0	15.0	15.0	45.0
average%	74.9	69.9	69.6	71.5
excl.dr.	74.9	69.9	69.6	71.5
>=100%	84	34	11	22
90.. <lt;100%< td=""><td>1</td><td>26</td><td>11</td><td>26</td></lt;100%<>	1	26	11	26
80.. <lt;90%< td=""><td>5</td><td>50</td><td>58</td><td>26</td></lt;90%<>	5	50	58	26
70.. <lt;80%< td=""><td>13</td><td>12</td><td>35</td><td>36</td></lt;80%<>	13	12	35	36
60.. <lt;70%< td=""><td>17</td><td>30</td><td>43</td><td>34</td></lt;70%<>	17	30	43	34
50.. <lt;60%< td=""><td>12</td><td>5</td><td>16</td><td>34</td></lt;60%<>	12	5	16	34
40.. <lt;50%< td=""><td>35</td><td>14</td><td>17</td><td>15</td></lt;50%<>	35	14	17	15
35.. <lt;40%< td=""><td>8</td><td>0</td><td>3</td><td>4</td></lt;40%<>	8	0	3	4
30.. <lt;35%< td=""><td>14</td><td>7</td><td>4</td><td>6</td></lt;35%<>	14	7	4	6
20.. <lt;30%< td=""><td>16</td><td>16</td><td>8</td><td>3</td></lt;30%<>	16	16	8	3
10.. <lt;20%< td=""><td>0</td><td>3</td><td>0</td><td>0</td></lt;20%<>	0	3	0	0
1.. <lt;10%< td=""><td>0</td><td>3</td><td>0</td><td>0</td></lt;10%<>	0	3	0	0
< 1%	1	6	0	0

histogram for test #1

	q1	q2	q3	t1
out of	10.0	15.0	15.0	45.0
average%	74.9	69.9	69.6	71.5
excl.dr.	74.9	69.9	69.6	71.5
>=100%	84	34	11	22
90.. <lt;100%< td=""><td>1</td><td>26</td><td>11</td><td>26</td></lt;100%<>	1	26	11	26
80.. <lt;90%< td=""><td>5</td><td>50</td><td>58</td><td>26</td></lt;90%<>	5	50	58	26
70.. <lt;80%< td=""><td>13</td><td>12</td><td>35</td><td>36</td></lt;80%<>	13	12	35	36
60.. <lt;70%< td=""><td>17</td><td>30</td><td>43</td><td>34</td></lt;70%<>	17	30	43	34
50.. <lt;60%< td=""><td>12</td><td>5</td><td>16</td><td>34</td></lt;60%<>	12	5	16	34
40.. <lt;50%< td=""><td>35</td><td>14</td><td>17</td><td>15</td></lt;50%<>	35	14	17	15
35.. <lt;40%< td=""><td>8</td><td>0</td><td>3</td><td>4</td></lt;40%<>	8	0	3	4
30.. <lt;35%< td=""><td>14</td><td>7</td><td>4</td><td>6</td></lt;35%<>	14	7	4	6
20.. <lt;30%< td=""><td>16</td><td>16</td><td>8</td><td>3</td></lt;30%<>	16	16	8	3
10.. <lt;20%< td=""><td>0</td><td>3</td><td>0</td><td>0</td></lt;20%<>	0	3	0	0
1.. <lt;10%< td=""><td>0</td><td>3</td><td>0</td><td>0</td></lt;10%<>	0	3	0	0
< 1%	1	6	0	0

histogram for test #1

	q1	q2	q3	t1
out of	10.0	15.0	15.0	45.0
average%	74.9	69.9	69.6	71.5
excl.dr.	74.9	69.9	69.6	71.5
>=100%	84	34	11	22
90..<100%	1	26	11	26
80..<90%	5	50	58	26
70..<80%	13	12	35	36
60..<70%	17	30	43	34
50..<60%	12	5	16	34
40..<50%	35	14	17	15
35..<40%	8	0	3	4
30..<35%	14	7	4	6
20..<30%	16	16	8	3
10..<20%	0	3	0	0
1..<10%	0	3	0	0
< 1%	1	6	0	0