# Tímaflækja

## Gagnaskipan 2014

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# Afköst

- Hvernig mælum við afköst reiknirita?

# Kröfur

Mælingin þarf að vera óháð

- Tiltekinni útfærslu
- Tilteknum vélbúnaði
- Tilteknum gögnum

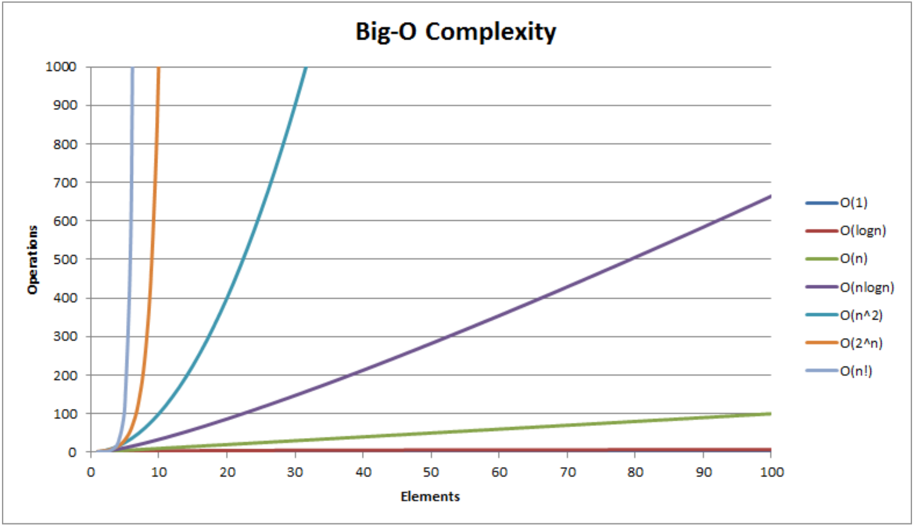
# Niðurstaðan

- Mælum fjölda aðgerða (e. operations)

# Big-O

- Lýsir því hvernig föll hegða sér „á endanum“
- Metum fjölda aðgerða miðað við stærð inntaks
- Hundsum fasta og litla liði

# Big-O



Big-O Complexity
Operations
1000
900
800
700
600
500
400
300
200
100
0
0
10
20
30
40
50
60
70
80
90
100
Elements
O(1)
O(logn)
O(n)
O(nlogn)
O(n^2)
O(2^n)
O(n!)

# Hvernig vaxa þessi föll?

| **Fall** \ $n$ | 10 | 100 | 1.000 | 10.000 | 100.000 | 1.000.000 |
|---|---|---|---|---|---|---|
| 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| $\log_2(n)$ | 3 | 6 | 9 | 13 | 16 | 19 |
| $n$ | 10 | $10^2$ | $10^3$ | $10^4$ | $10^5$ | $10^6$ |
| $n\log_2(n)$ | 30 | 664 | $10^4$ | $10^5$ | $10^6$ | $10^7$ |
| $n^2$ | $10^2$ | $10^4$ | $10^6$ | $10^8$ | $10^{10}$ | $10^{12}$ |
| $n^3$ | $10^3$ | $10^6$ | $10^9$ | $10^{12}$ | $10^{15}$ | $10^{18}$ |
| $2^n$ | $10^3$ | $10^{30}$ | $10^{300}$ | $10^{3.000}$ | $10^{30.000}$ | $10^{300.000}$ |
| $n!$ | $10^6$ | $10^{158}$ | $10^{2567}$ | $10^{36.000}$ | $10^{460.000}$ | $10^{5.600.000}$ |

# Af hverju þurfum við að hugsa út í þetta?

| **Fall** \ $n$ | 10 | $10^2$ | $10^3$ | $10^4$ | $10^5$ | $10^6$ |
|---|---|---|---|---|---|---|
| 1 | $< 1$ s | $< 1$ s | $< 1$ s | $< 1$ s | $< 1$ s | $< 1$ s |
| $\log_2(n)$ | $< 1$ s | $< 1$ s | $< 1$ s | $< 1$ s | $< 1$ s | $< 1$ s |
| $n$ | $< 1$ s | $< 1$ s | $< 1$ s | $< 1$ s | $< 1$ s | $< 1$ s |
| $n \log_2(n)$ | $< 1$ s | $< 1$ s | $< 1$ s | $< 1$ s | $< 1$ s | $< 1$ s |
| $n^2$ | $< 1$ s | $< 1$ s | $< 1$ s | $< 1$ s | 10 s | 16 m |
| $n^3$ | $< 1$ s | $< 1$ s | 1 s | 16 m | 12 d | 31 y |
| $2^n$ | $< 1$ s | $10^{13} y$ | $10^{283}$ y | ... | ... | ... |
| $n!$ | $< 1$ s | $10^{141} y$ | ... | ... | ... | ... |