

EADŠ - cvičenie 1 - zložitosti

22. septembra 2022

A

```
x = 0
for i in range(4 * n, 0, -1):
    x = x + 2 * i
```

A

```
x = 0
for i in range(4 * n, 0, -1):
    x = x + 2 * i
```

$O(n)$

B

```
z = 0
x = 0
i = 1
while i <= n:
    z += 5
    x *= 2
    i *= 3
```

B

```
z = 0
x = 0
i = 1
while i <= n:
    z += 5
    x *= 2
    i *= 3
```

$O(\ln n)$

C

```
y = 0
j = 1
while j*j <= n:
    y += 1
    j += 1
```

C

```
y = 0
j = 1
while j*j <= n:
    y += 1
    j += 1
```

$O(\sqrt{n})$

D

```
b = 0
i = n
for i in range(n, 0, -1):
    for j in range(0, i, 1):
        b += 5
```


D

```
b = 0
i = n
for i in range(n, 0, -1):
    for j in range(0, i, 1):
        b += 5
```

$O(n^2)$

E

```
y = 0
for j in range(0, 2*n + 1, 2):
    y += j

s = 0
for i in range(1, j + 1, 1):
    s += 1
```

E

```
y = 0
for j in range(0, 2*n + 1, 2):
    y += j
```

```
s = 0
for i in range(1, j + 1, 1):
    s += 1
```

$O(n)$

F

```
b = 0
for i in range(1, n+1, 1):
    for j in range(1, (i*n)+1, 1):
        b += 5
```

F

```
b = 0
for i in range(1, n+1, 1):
    for j in range(1, (i*n)+1, 1):
        b += 5
```

$O(n^3)$

G

```
x = 0
i = 1
while i <= n:
    if i % 2 != 0:
        for j in range(0, i, 1):
            x += 1
    i *= 3
```

G

```
x = 0
i = 1
while i <= n:
    if i % 2 != 0:
        for j in range(0, i, 1):
            x += 1
    i *= 3
```

$O(n)$

H

```
t = 0
for i in range(1, n+1, 1):
    j = 0
    while j*j < 4*n:
        k = 1
        while k*k <= 9*n:
            t += 1
            k += 1
        j += 1
```


H

```
t = 0
for i in range(1, n+1, 1):
    j = 0
    while j*j < 4*n:
        k = 1
        while k*k <= 9*n:
            t += 1
            k += 1
        j += 1
```

$O(n^2)$

```
a = 0
k = n*n
while k > 1:
    for j in range(0, n*n, 1):
        a += 1
    k /= 2
```

```
a = 0
k = n*n
while k > 1:
    for j in range(0, n*n, 1):
        a += 1
    k /= 2
```

$O(n^2 \cdot \log n)$

J

```
i = 0
j = 0
y = 0
s = 0
for j in range(1, n+1, 1):
    y += j
    for i in range(1, y+1, 1):
        s += 1
```

```
i = 0
j = 0
y = 0
s = 0
for j in range(1, n+1, 1):
    y += j
    for i in range(1, y+1, 1):
        s += 1
```

$$1 + 3 + 6 + 10 + \dots = \sum_{i=1}^n \frac{i(i+1)}{2}$$
$$1/2 \cdot (\sum_{i=1}^n i^2 + \sum_{i=1}^n i)$$
$$1/2 \cdot (n(n+1)(2n+1)/6 + n(n+1)/2)$$
$$O(n^3)$$

K

```
i = 1
z = 0
while z < n*(n+1)/2:
    z += i
    i += 1
```

K

```
i = 1
z = 0
while z < n*(n+1)/2:
    z += i
    i += 1
```

$O(n)$

L

```
a = 0
k = n*n*n
while k > 1:
    for j in range(0, k, 1):
        a -= 1
    k /= 2
```


L

```
a = 0
k = n*n*n
while k > 1:
    for j in range(0, k, 1):
        a -= 1
    k /= 2
```

$$n^3 + n^3/2 + n^3/4 + n^3/8...$$
$$O(n^3)$$

M

```
for i in range(0, n, 1):  
    j = 0  
    while j < n:  
        x += 1  
        j += i
```

M

```
for i in range(0, n, 1):  
    j = 0  
    while j < n:  
        x += 1  
        j += i
```

$O(n \ln n)$

N

```
# %% kmp preparation
m = n // 20
A = "A"*n
B = "A"*m + "$"
kmp = [0] + list(range(m)) # kmp[0] = 0, kmp[i] < i
```

N

```
# %% kmp preparation
m = n // 20
A = "A"*n
B = "A"*m + "$"
kmp = [0] + list(range(m)) # kmp[0] = 0, kmp[i] < i

cur = 0
for i in range(n):
    while cur != 0 and A[i] != B[cur]:
        cur = kmp[cur]
    if A[i] == B[cur]:
        cur += 1
```

N

```
# %% kmp preparation
m = n // 20
A = "A"*n
B = "A"*m + "$"
kmp = [0] + list(range(m)) # kmp[0] = 0, kmp[i] < i

cur = 0
for i in range(n):
    while cur != 0 and A[i] != B[cur]:
        cur = kmp[cur]
    if A[i] == B[cur]:
        cur += 1
```

$O(n)$

Zorad'te funkcie

$47n^3, 42n, 23n^2 + 4n + 3, 0.0001n^2, 2^n, 3^n,$
 $n^{200} * 1.99^n, n^n, 2^{\ln n}, n!, \ln n, \ln(n^{100}), \ln n!,$
 $\ln n^n, n \cdot \ln n, n \cdot (\ln n)^2, (n + 1)!$

Riešenie

$$\ln n, \ln(n^{100})$$

$$42n, 2^{\ln n} (= n^{\ln 2} = n)$$

$$\ln n!$$

$$n \cdot (\ln n)^2$$

$$n \cdot \ln n, \ln n^n$$

$$0.0001n^2, 23n^2 + 4n + 3$$

$$47n^3$$

$$n^{200} * 1.99^n, 2^n, 3^n$$

$$n!, (n + 1)!$$

$$n^n$$