

CSC165 fall 2017

worst/best/average

Danny Heap

csc16517f@cs.toronto.edu

BA4270 (behind elevators)

Web page:

<http://www.teach.cs.toronto.edu/~heap/165/F17/>

416-978-5899

Using Course notes: more Induction



Outline

notes



compare...

```
def is_prime(n):  
    if n < 2:  
        return False  
    else:  
        for d in range(2,n):  
            if n % d == 0:  
                return False  
        return True
```

```
def has_even(number_list):  
    for number in number_list:  
        if number % 2 == 0:  
            return True  
    return False
```



definitions

- ▶ $\mathcal{I}_{f,n} = \{i \mid i \text{ is an input to } f \wedge |i| = n\}$
- ▶ $RT_{f(x)} = \text{number of basic "steps" in executing } f(x)$
- ▶ $WC_f(n) = \max\{RT_{f(x)} \mid x \in \mathcal{I}_{f,n}\}$



upper bounds, lower bounds...

- ▶ $U(n)$ is an upper bound means
 $\forall n \in \mathbb{N}, \forall x \in \mathcal{I}_{f,n}, RT_{f(x)} \leq U(n)$

- ▶ $L(n)$ is a lower bound means
 $\forall n \in \mathbb{N}, \exists x \in \mathcal{I}_{f,n}, RT_{f(x)} \geq L(n)$

why the asymmetry of U and L ?



$$WC_{\text{has_even}} \in O(n)$$



palindromes

examples: “racecar rotor pap...” every string **starts** with a palindrome, so find the longest palindrome prefix...

```
def palindrome_prefix(s):
    n = len(s)
    for prefix_length in range(n, 0, -1): # count down from n
        is_palindrome = True
        for i in range(prefix_length):
            if s[i] != s[prefix_length - 1 - i]:
                is_palindrome = False
                break
        if is_palindrome:
            return prefix_length
```



average...

$$\mathcal{I}_{f,n} = \{i \mid i \text{ is an input to } f \wedge |i| = n\}$$

$$\mathcal{T}_{f,n} = \{t \mid \exists x \in \mathcal{I}_{f,n}, t = RT_f(x)\}$$

```
def has_even(number_list):  
    for number in number_list:  
        if number % 2 == 0:  
            return True  
    return False
```



Notes