



MACQUARIE
University

Department of Computing

ITEC625 Fundamentals of Computer Science
Workshop - Workshop - Time Complexity

Learning outcomes

By the end of this session, you will have learnt the basics about time complexity.

Questions

1. What are the degrees of the following polynomials?

$$5x^3 + 3x - 7 \quad (1)$$

$$5x - 2x^6 \quad (2)$$

2. What are the time complexities of the following codes?

```
int x = 1;
if(x % 2 == 0) {
    x++;
}
else {
    x--;
}
```

```
for(int i=0; i < 100; i++) {
    System.out.print(i+ "_");
}
```

```
for(int i=0; i < n; i++) {
    System.out.print(i+ "_");
}
```

```
for(int i=0; i < n; i+=2) {
    if(i%3 == 0) {
        System.out.print(i+ "._");
    }
    else {
        if(i%5 == 0) {
            System.out.print(i+ "!.");
        }
    }
}
```

```

        }
        else {
            System.out.print(i+ "?_");
        }
    }
}

```

```

for(int i=1; i < n; i*=2) {
    System.out.print(i+ "_");
}

```

```

for(int i=0; i < n; i+=n/5) {
    System.out.print(i+ "_");
}

```

```

for(int i=6; i < n/2; i++) {
    System.out.print(i+ "_");
}

```

```

for(int i=n/3; i < n/2; i+=4) {
    System.out.print(i+ "_");
}

```

```

for(double i=1; i*i <=n; i++) {
    System.out.print(i+ "_");
}

```

```

for(int i=0; i < n; i++) {
    for(int k=0; k < n; k++) {
        System.out.println(i+"_");
    }
}

```

```

for(int i=0; i < n; i++) {
    for(int k=0; k < n; k++) {
        if(i%3 == 0) {
            System.out.print(i+ "._");
        }
        else {
            if(i%5 == 0) {
                System.out.print(i+ "!_");
            }
            else {

```

```
        System.out.print(i+ "?_");  
    }  
  
}
```

```
for(int i=n; i > 0; i-=2) {
    for(int k=1; k <= n; k+=3) {
        if(i%3 == 0) {
            System.out.print(i+ "._");
        }
        else {
            if(i%5 == 0) {
                System.out.print(i+ "!_");
            }
            else {
                System.out.print(i+ "?_");
            }
        }
    }
}
```

```
for(int i=0; i < n; i++) {
    for(int k=1; k <= n; k*=2) {
        if(i%3 == 0) {
            System.out.print(i+ "._");
        }
        else {
            if(i%5 == 0) {
                System.out.print(i+ "!.");
            }
            else {
                System.out.print(i+ "?.");
            }
        }
    }
}
```

```
for(int i=1; i < n/2; i*=2) {
    for(int k=1; k < n/2; k*=2) {
        if(i%3 == 0) {
            System.out.print(i+ "._");
        }
        else {
            if(i%5 == 0) {
                System.out.print(i+ "!.");
            }
            else {
```

```

                                System.out.print(i+ "?_");
                                }
                                }
                                }
}

```

```

for(double i=1; i<=n; i+=1.0/n) {
    System.out.print(i+ "_");
}

```

3. What is the time complexities for the method foo in each of the following codes?

```

void foo(int n) {
    for(int i=0; i < n; i++) {
        System.out.print(i+ "_");
    }
}

```

```

int foo(int n) {
    int result = 0;
    for(int i=0; i < n; i++) {
        result+=bar(n);
    }
    return result;
}

int bar(int n) {
    return n%2;
}

```

```

int foo(int n) {
    int result = 0;
    for(int i=n; i > 0; i--) {
        result+=bar(i);
    }
    return result;
}

int bar(int n) {
    return n%2;
}

```

```

int foo(int n) {
    int result = 0;
    for(int i=n; i > 0; i--) {
        result+=bar(i);
    }
}

```

```

    }
    return result;
}

int bar(int n) {
    int total = 0;
    for(int i=1; i<=n; i+=2) {
        total+=i;
    }
    return total;
}

```

```

int foo(int[] arr) {
    for(int i=1; i < arr.length; i++) {
        if(arr[i] < arr[i-1]) {
            return false;
        }
    }
    return true;
}

```

4. Write a piece of code with $O(\log_2 n)$ time complexity.
5. Write a piece of code with a best case time complexity of $O(n)$ and worst case time complexity of $O(n^2)$.
6. Is it possible to have a code with a best case time complexity of $O(n^2)$ and worst case time complexity of $O(n * \log_2 n)$?