

# QB1

## Big Oh (simple)

Do NOT write on this test. Record all answers on the bubble sheet. **Closed book. No notes.** Work strictly from memory. No time limit. **No calculators. Scratch paper okay.**

1/2p. Give a tight big-oh  $\Theta()$  bound on the running time  $T(n)$  of this program.

Assume `atoi`, `simpleStatement`, and `simpleCompare` each run in  $\Theta(1)$  time.

- (A)  $n^9$  (C)  $n^7$  (E)  $n^5$  (G)  $n^3$  (I)  $n$   
(B)  $n^8$  (D)  $n^6$  (F)  $n^4$  (H)  $n^2$  (J) 1

```
int main ( int argc, char * * argv ) {
    int n = atoi(argv[1]);
    if ( simpleCompare ) {
        for ( k = 1 ; k < n ; k += 5 ) {
            if ( simpleCompare ) {
                simpleStatement;
            }
        }
    } else {
        simpleStatement;
    }
    return 0; }
```

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2/2p. Give a tight big-oh  $\Theta()$  bound on the running time  $T(n)$  of this program.

Assume `atoi`, `simpleStatement`, and `simpleCompare` each run in  $\Theta(1)$  time.

- (A)  $n^9$  (C)  $n^7$  (E)  $n^5$  (G)  $n^3$  (I)  $n$   
(B)  $n^8$  (D)  $n^6$  (F)  $n^4$  (H)  $n^2$  (J) 1

```
int main ( int argc, char * * argv ) {
    int n = atoi(argv[1]);
    for ( g = 1 ; g < n ; g++ ) {
        if ( simpleCompare ) {
            if ( simpleCompare ) {
                for ( h = n ; h > 1 ; h -= 10 ) {
                    if ( simpleCompare ) {
                        simpleStatement;
                    } else {
                        simpleStatement;
                    }
                }
            } else {
                if ( simpleCompare ) {
                    simpleStatement;
                } else {
                    simpleStatement;
                }
            }
        }
    }
    return 0; }
```

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3/2p. Give a tight big-oh  $\Theta()$  bound on the running time  $T(n)$  of this program.  
Assume `atoi`, `simpleStatement`, and `simpleCompare` each run in  $\Theta(1)$  time.

- (A)  $n^9$  (C)  $n^7$  (E)  $n^5$  (G)  $n^3$  (I)  $n$   
(B)  $n^8$  (D)  $n^6$  (F)  $n^4$  (H)  $n^2$  (J) 1

```
int main ( int argc, char * * argv ) {
    int n = atoi(argv[1]);
    b = n; while ( b > 1 ) {
        d = 1; while ( d < n ) {
            if ( simpleCompare ) {
                if ( simpleCompare ) {
                    if ( simpleCompare ) {
                        f = n; while ( f > 1 ) {
                            if ( simpleCompare ) {
                                simpleStatement;
                            }
                            f -= 3; }
                    }
                } else {
                    for ( e = n ; e > 1 ; e -= 2 ) {
                        a = 1; while ( a < n ) {
                            simpleStatement;
                            a++; }
                    }
                }
            } else {
                for ( h = 1 ; h < n ; h += 3 ) {
                    if ( simpleCompare ) {
                        if ( simpleCompare ) {
                            if ( simpleCompare ) {
                                simpleStatement;
                            } else {
                                simpleStatement;
                            }
                        } else {
                            simpleStatement;
                        }
                    } else {
                        simpleStatement;
                    }
                }
            }
        }
        d += 10; }
    b--; }
return 0; }
```

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4/2p. Give a tight big-oh  $\Theta()$  bound on the running time  $T(n)$  of this program.  
Assume `atoi`, `simpleStatement`, and `simpleCompare` each run in  $\Theta(1)$  time.

- (A)  $n^9$  (C)  $n^7$  (E)  $n^5$  (G)  $n^3$  (I)  $n$   
(B)  $n^8$  (D)  $n^6$  (F)  $n^4$  (H)  $n^2$  (J) 1

```
int main ( int argc, char * * argv ) {
    int n = atoi(argv[1]);
    g = 1; do {
        for ( d = 1 ; d < n ; d += 10 ) {
            if ( simpleCompare ) {
                if ( simpleCompare ) {
                    h = 1; while ( h < n ) {
                        if ( simpleCompare ) {
                            if ( simpleCompare ) {
                                e = n; while ( e > 1 ) {
                                    simpleStatement;
                                    e -= 2; }
                                } else {
                                    simpleStatement;
                                }
                            } else {
                                j = 1; do {
                                    simpleStatement;
                                    j += 1; } while ( j < n );
                                }
                            h++; }
                    } else {
                        if ( simpleCompare ) {
                            if ( simpleCompare ) {
                                k = 1; do {
                                    simpleStatement;
                                    k += 3; } while ( k < n );
                                } else {
                                    simpleStatement;
                                }
                            } else {
                                if ( simpleCompare ) {
                                    simpleStatement;
                                }
                            }
                        }
                    }
                }
            }
        }
    }
    g += 10; } while ( g < n );
    return 0; }
```

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5/2p. Give a tight big-oh  $\Theta()$  bound on the running time  $T(n)$  of this program.  
Assume `atoi`, `simpleStatement`, and `simpleCompare` each run in  $\Theta(1)$  time.

- (A)  $n^9$  (C)  $n^7$  (E)  $n^5$  (G)  $n^3$  (I)  $n$   
(B)  $n^8$  (D)  $n^6$  (F)  $n^4$  (H)  $n^2$  (J) 1

```
int main ( int argc, char * * argv ) {
    int n = atoi(argv[1]);
    if ( simpleCompare ) {
        for ( a = n ; a > 1 ; a -= 1 ) {
            if ( simpleCompare ) {
                if ( simpleCompare ) {
                    for ( d = 1 ; d < n ; d++ ) {
                        if ( simpleCompare ) {
                            if ( simpleCompare ) {
                                simpleStatement;
                            }
                        }
                    }
                } else {
                    if ( simpleCompare ) {
                        if ( simpleCompare ) {
                            simpleStatement;
                        }
                    } else {
                        simpleStatement;
                    }
                }
            } else {
                if ( simpleCompare ) {
                    if ( simpleCompare ) {
                        c = 1; do {
                            simpleStatement;
                            c++; } while ( c < n );
                    } else {
                        simpleStatement;
                    }
                } else {
                    g = 1; while ( g < n ) {
                        simpleStatement;
                        g += 10; }
                }
            }
        }
    }
    return 0; }
```

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CS 201 Big Oh (simple)

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Total points 10.

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**Answer Key** (points per line)

1 (2).	I ( $n$ )
2 (2).	H ( $n^2$ )
3 (2).	F ( $n^4$ )
4 (2).	F ( $n^4$ )
5 (2).	H ( $n^2$ )

Total points 10.