

# 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]);
    for ( k = n ; k > 1 ; k -= 5 ) {
        d = n; do {
            if ( simpleCompare ) {
                if ( simpleCompare ) {
                    simpleStatement;
                } else {
                    simpleStatement;
                }
            } else {
                simpleStatement;
            }
            d -= 1; } while ( d > 1 );
    }
    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]);
    if ( simpleCompare ) {
        j = 1; while ( j < n ) {
            if ( simpleCompare ) {
                simpleStatement;
            } else {
                simpleStatement;
            }
            j += 1; }
    } 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]);
    if ( simpleCompare ) {
        c = 1; while ( c < n ) {
            i = 1; do {
                if ( simpleCompare ) {
                    d = n; do {
                        if ( simpleCompare ) {
                            simpleStatement;
                        } else {
                            simpleStatement;
                        }
                    } while ( d > 1 );
                } else {
                    if ( simpleCompare ) {
                        simpleStatement;
                    } else {
                        simpleStatement;
                    }
                }
                i++; } while ( i < n );
            c += 1; }
    } else {
        a = n; do {
            if ( simpleCompare ) {
                if ( simpleCompare ) {
                    if ( simpleCompare ) {
                        simpleStatement;
                    }
                } else {
                    simpleStatement;
                }
            }
            a--; } while ( a > 1 );
    }
    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]);
    e = n; while ( e > 1 ) {
        if ( simpleCompare ) {
            if ( simpleCompare ) {
                if ( simpleCompare ) {
                    for ( b = n ; b > 1 ; b -= 5 ) {
                        d = n; while ( d > 1 ) {
                            if ( simpleCompare ) {
                                if ( simpleCompare ) {
                                    for ( j = n ; j > 1 ; j -= 1 ) {
                                        simpleStatement;
                                    }
                                } else {
                                    simpleStatement;
                                }
                            } else {
                                k = 1; while ( k < n ) {
                                    simpleStatement;
                                    k += 5; }
                                }
                            d -= 1; }
                        }
                    } else {
                        if ( simpleCompare ) {
                            a = n; do {
                                if ( simpleCompare ) {
                                    simpleStatement;
                                }
                                a -= 5; } while ( a > 1 );
                            } else {
                                if ( simpleCompare ) {
                                    simpleStatement;
                                } else {
                                    simpleStatement;
                                }
                            }
                        }
                    }
                }
            }
        }
        e -= 10; }
    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 ) {
        if ( simpleCompare ) {
            if ( simpleCompare ) {
                if ( simpleCompare ) {
                    e = n; while ( e > 1 ) {
                        simpleStatement;
                        e--; }
                } else {
                    simpleStatement;
                }
            }
        } else {
            if ( simpleCompare ) {
                k = n; do {
                    simpleStatement;
                    k--; } while ( k > 1 );
            } else {
                simpleStatement;
            }
        }
    } else {
        if ( simpleCompare ) {
            f = n; do {
                if ( simpleCompare ) {
                    simpleStatement;
                } else {
                    simpleStatement;
                }
                f--; } while ( f > 1 );
        } else {
            if ( simpleCompare ) {
                simpleStatement;
            } else {
                simpleStatement;
            }
        }
    }
    return 0; }
```

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Bro Colton

CS 201 Big Oh (simple)

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Total points 10.

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**Answer Key** (points per line)

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

Total points 10.