

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]);
    g = 1; do {
        i = n; do {
            j = 1; do {
                k = n; do {
                    for ( d = 1 ; d < n ; d += 1 ) {
                        b = n; do {
                            simpleStatement;
                            b--; } while ( b > 1 );
                        }
                    k -= 2; } while ( k > 1 );
                j++; } while ( j < n );
            i -= 3; } while ( i > 1 );
        g += 5; } while ( g < n );
    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]);
    j = n; while ( j > 1 ) {
        if ( simpleCompare ) {
            if ( simpleCompare ) {
                a = n; do {
                    if ( simpleCompare ) {
                        simpleStatement;
                    }
                a--; } while ( a > 1 );
            }
        } else {
            for ( d = n ; d > 1 ; d -= 10 ) {
                simpleStatement;
            }
        }
        j--; }
    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]);
    for ( b = n ; b > 1 ; b-- ) {
        if ( simpleCompare ) {
            d = 1; do {
                if ( simpleCompare ) {
                    g = 1; do {
                        if ( simpleCompare ) {
                            if ( simpleCompare ) {
                                a = n; while ( a > 1 ) {
                                    simpleStatement;
                                    a -= 10; }
                            } else {
                                simpleStatement;
                            }
                        } else {
                            simpleStatement;
                        }
                    } while ( g < n );
                }
                d += 3; } while ( d < n );
        } else {
            if ( simpleCompare ) {
                if ( simpleCompare ) {
                    k = n; do {
                        simpleStatement;
                        k--; } while ( k > 1 );
                } else {
                    simpleStatement;
                }
            } else {
                if ( simpleCompare ) {
                    simpleStatement;
                } else {
                    simpleStatement;
                }
            }
        }
    }
    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]);
    if ( simpleCompare ) {
        if ( simpleCompare ) {
            c = n; do {
                j = 1; while ( j < n ) {
                    if ( simpleCompare ) {
                        for ( k = 1 ; k < n ; k++ ) {
                            simpleStatement;
                        }
                    }
                    j++; }
                c--; } while ( c > 1 );
        } else {
            g = n; do {
                if ( simpleCompare ) {
                    simpleStatement;
                }
                g--; } while ( g > 1 );
        }
    } else {
        if ( simpleCompare ) {
            if ( simpleCompare ) {
                if ( simpleCompare ) {
                    if ( simpleCompare ) {
                        simpleStatement;
                    }
                }
            }
        } else {
            if ( simpleCompare ) {
                simpleStatement;
            } else {
                simpleStatement;
            }
        }
    }
    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]);
    i = 1; do {
        if ( simpleCompare ) {
            if ( simpleCompare ) {
                for ( d = n ; d > 1 ; d-- ) {
                    for ( h = 1 ; h < n ; h += 3 ) {
                        if ( simpleCompare ) {
                            simpleStatement;
                        } else {
                            simpleStatement;
                        }
                    }
                }
            } else {
                if ( simpleCompare ) {
                    if ( simpleCompare ) {
                        simpleStatement;
                    }
                } else {
                    simpleStatement;
                }
            }
        } else {
            f = n; do {
                for ( a = n ; a > 1 ; a -= 3 ) {
                    if ( simpleCompare ) {
                        j = 1; do {
                            for ( b = 1 ; b < n ; b++ ) {
                                simpleStatement;
                            }
                            j++; } while ( j < n );
                        }
                    }
                    f--; } while ( f > 1 );
                }
            }
        }
    } while ( i < n );
    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).	D (n^6)
2 (2).	H (n^2)
3 (2).	F (n^4)
4 (2).	G (n^3)
5 (2).	E (n^5)

Total points 10.