

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]);
    d = 1; do {
        h = 1; do {
            for ( i = n ; i > 1 ; i-- ) {
                if ( simpleCompare ) {
                    simpleStatement;
                } else {
                    simpleStatement;
                }
            }
            h += 1; } while ( h < n );
        d += 2; } while ( d < 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]);
    if ( simpleCompare ) {
        for ( e = n ; e > 1 ; e-- ) {
            if ( simpleCompare ) {
                if ( simpleCompare ) {
                    simpleStatement;
                }
            } else {
                simpleStatement;
            }
        }
    } else {
        if ( simpleCompare ) {
            simpleStatement;
        } else {
            simpleStatement;
        }
    }
    return 0; }
```

QB1

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

QB1

- 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 ) {
            f = 1; while ( f < n ) {
                if ( simpleCompare ) {
                    e = n; while ( e > 1 ) {
                        if ( simpleCompare ) {
                            h = 1; while ( h < n ) {
                                if ( simpleCompare ) {
                                    if ( simpleCompare ) {
                                        if ( simpleCompare ) {
                                            simpleStatement;
                                        }
                                    }
                                }
                            }
                        }
                    }
                }
                h++; }
            }
            e--; }
        } else {
            i = n; do {
                if ( simpleCompare ) {
                    c = 1; while ( c < n ) {
                        for ( b = n ; b > 1 ; b -= 2 ) {
                            simpleStatement;
                        }
                    }
                    c += 1; }
                } else {
                    simpleStatement;
                }
                i--; } while ( i > 1 );
            }
            f += 2; }
        }
    }
    return 0; }
```

QB1

- 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 ) {
        f = 1; do {
            if ( simpleCompare ) {
                k = n; do {
                    if ( simpleCompare ) {
                        if ( simpleCompare ) {
                            c = n; do {
                                simpleStatement;
                                c -= 5; } while ( c > 1 );
                            }
                        } else {
                            simpleStatement;
                        }
                    } while ( k > 1 );
                }
            }
            f += 5; } while ( f < n );
    } else {
        if ( simpleCompare ) {
            if ( simpleCompare ) {
                if ( simpleCompare ) {
                    if ( simpleCompare ) {
                        d = 1; do {
                            simpleStatement;
                            d += 5; } while ( d < n );
                    } else {
                        simpleStatement;
                    }
                } else {
                    simpleStatement;
                }
            }
        }
    }
}
return 0; }
```

QB1

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CS 201 Big Oh (simple)

5

Total points 10.

QB1

Answer Key (points per line)

1	(2).	G	(n^3)
2	(2).	I	(n)
3	(2).	D	(n^6)
4	(2).	F	(n^4)
5	(2).	G	(n^3)

Total points 10.