

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]);
    c = n; while ( c > 1 ) {
        j = n; while ( j > 1 ) {
            for ( a = n ; a > 1 ; a-- ) {
                h = 1; do {
                    if ( simpleCompare ) {
                        simpleStatement;
                    } else {
                        simpleStatement;
                    }
                }
                h++; } while ( h < n );
            }
            j -= 2; }
        c -= 5; }
    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 ( j = n ; j > 1 ; j -= 2 ) {
            a = n; do {
                for ( e = n ; e > 1 ; e -= 1 ) {
                    simpleStatement;
                }
                a--; } while ( a > 1 );
            }
        } else {
            for ( i = n ; i > 1 ; i-- ) {
                b = 1; do {
                    simpleStatement;
                } while ( b < n );
            }
        }
    }
    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]);
    if ( simpleCompare ) {
        g = n; while ( g > 1 ) {
            if ( simpleCompare ) {
                if ( simpleCompare ) {
                    if ( simpleCompare ) {
                        if ( simpleCompare ) {
                            if ( simpleCompare ) {
                                j = 1; do {
                                    i = 1; while ( i < n ) {
                                        simpleStatement;
                                        i += 2; }
                                    j++; } while ( j < n );
                                }
                            } else {
                                for ( b = 1 ; b < n ; b++ ) {
                                    for ( d = n ; d > 1 ; d-- ) {
                                        simpleStatement;
                                    }
                                }
                            }
                        } else {
                            if ( simpleCompare ) {
                                if ( simpleCompare ) {
                                    if ( simpleCompare ) {
                                        if ( simpleCompare ) {
                                            simpleStatement;
                                        }
                                    }
                                } else {
                                    simpleStatement;
                                }
                            } else {
                                h = 1; do {
                                    simpleStatement;
                                    h += 1; } while ( h < n );
                            }
                        }
                    }
                }
            }
        }
        g--; }
    }
    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]);
    b = n; do {
        a = n; while ( a > 1 ) {
            for ( k = n ; k > 1 ; k -= 2 ) {
                if ( simpleCompare ) {
                    if ( simpleCompare ) {
                        d = n; while ( d > 1 ) {
                            for ( j = 1 ; j < n ; j++ ) {
                                if ( simpleCompare ) {
                                    if ( simpleCompare ) {
                                        g = n; while ( g > 1 ) {
                                            for ( e = n ; e > 1 ; e-- ) {
                                                simpleStatement;
                                            }
                                        }
                                        g -= 10; }
                                    } else {
                                        simpleStatement;
                                    }
                                }
                            }
                        }
                    }
                }
            }
            d--; }
        }
    } else {
        if ( simpleCompare ) {
            f = n; do {
                if ( simpleCompare ) {
                    if ( simpleCompare ) {
                        if ( simpleCompare ) {
                            simpleStatement;
                        }
                    }
                }
            }
            f--; } while ( f > 1 );
        }
    }
    a -= 2; }
    b--; } while ( b > 1 );
    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 ) {
    for ( k = n ; k > 1 ; k -= 3 ) {
      b = n; while ( b > 1 ) {
        for ( a = n ; a > 1 ; a-- ) {
          if ( simpleCompare ) {
            if ( simpleCompare ) {
              if ( simpleCompare ) {
                if ( simpleCompare ) {
                  simpleStatement;
                } else {
                  simpleStatement;
                }
              } else {
                simpleStatement;
              }
            } else {
              simpleStatement;
            }
          } else {
            for ( c = 1 ; c < n ; c += 5 ) {
              if ( simpleCompare ) {
                simpleStatement;
              } else {
                simpleStatement;
              }
            }
          }
        }
      }
    }
    b -= 10; }
  }
  return 0; }
```

QB1

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CS 201 Big Oh (simple)

5

Total points 10.

QB1

Answer Key (points per line)

1 (2).	F (n^4)
2 (2).	G (n^3)
3 (2).	G (n^3)
4 (2).	C (n^7)
5 (2).	F (n^4)

Total points 10.