

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

On the following printf questions you are given a list of inputs. For each problem line determine which printf statement created the accompanying outputs. (means space.)

Which of these printf statements created the outputs shown for each problem below? (x is int x;)

- (A) printf("____%-3d",x); (D) printf("_%_-4d",x); (G) printf("%+07d",x);
 (B) printf("____%0_3d",x); (E) printf("_%_-+3d",x); (H) printf("%0_5d",x);
 (C) printf("____%04d",x); (F) printf("_%_-+6d",x); (I) printf("%5d",x);

inputs:	<u> 4 </u>	<u> -2 </u>	<u>1088299423</u>	<u>-2012309689</u>
1/2p.	____4_____	_-2_____	__1088299423__	_ -2012309689__
2/2p.	____4____	_____-2__	1088299423__	-2012309689__
3/2p.	____0004__	____-002__	__1088299423__	__ -2012309689__
4/2p.	____+4_____	____-2_____	____+1088299423_____	____-2012309689_____

Which of these printf statements created the outputs shown for each problem below? (x is char * x;)

- (A) printf("_____%s",x); (D) printf("_%3s",x); (G) printf("%-4s",x);
 (B) printf("_%_-2s",x); (E) printf("_%4s",x); (H) printf("%-5s",x);
 (C) printf("_%1s",x); (F) printf("%-3s",x); (I) printf("%5s",x);

inputs:	<u>""</u>	<u>"p"</u>	<u>"kc"</u>	<u>"cldp"</u>	<u>"wkvjvw"</u>	<u>"dcvzxwbf"</u>
5/2p.	____	____p	____kc	_cldp	wkvjvw	dcvzxwbf
6/2p.	____	p____	kc____	cldp__	wkvjvw__	dcvzxwbf__
7/2p.	____	p____	_kc____	_cldp____	_wkvjvw____	_dcvzxwbf____
8/2p.	____	____p	____kc	_cldp__	_wkvjvw__	_dcvzxwbf__

Which of these printf statements created the outputs shown for each problem below? (x is double x;)

- (A) printf("_%+011.6f",x); (D) printf("_%12f",x); (G) printf("%+0+14.0f",x);
 (B) printf("_%+013.0f",x); (E) printf("%+13.2f",x); (H) printf("%014.4f",x);
 (C) printf("_%+013.4f",x); (F) printf("%0+12.2f",x); (I) printf("%014f",x);

inputs:	<u> 5 </u>	<u> 2.88 </u>	<u> 6.6602 </u>	<u>-98797.292418</u>
9/2p.	____+0000005.0000	____+0000002.8800	____+0000006.6602	____-0098797.2924
10/2p.	____+005.000000__	____+002.880000__	____+006.660200__	____-98797.292418__
11/2p.	0000005.000000	0000002.880000	0000006.660200	-098797.292418
12/2p.	+00000005.00__	+00000002.88__	+00000006.66__	-00098797.29__

Precedence: What is the value of each expression? Mark (I) for error, (J) for none of the above.

13/1p.	$5-7+3\%1+7$	(A) -92	(B) -9	(C) -5	(D) 1	(E) 3	(F) 5	(G) 7	(H) 12
14/1p.	$5+9\%8-7\%5$	(A) -96	(B) -48	(C) 0	(D) 2	(E) 4	(F) 5	(G) 84	(H) 95
15/1p.	$3>7>=1*6-9$	(A) -72	(B) -9	(C) -8	(D) -3	(E) 1	(F) 22	(G) 24	(H) 74
16/1p.	$7*8\%5+5/8$	(A) -44	(B) -39	(C) 1	(D) 3	(E) 7	(F) 21	(G) 36	(H) 88
17/1p.	$3+6+6==9>0$	(A) -86	(B) -72	(C) 1	(D) 3	(E) 4	(F) 9	(G) 31	(H) 35
18/1p.	$6-2\%7\%4-3$	(A) -3	(B) -2	(C) 0	(D) 1	(E) 3	(F) 6	(G) 7	(H) 27
19/1p.	$8/7-7/8+8$	(A) -75	(B) -8	(C) -7	(D) -1	(E) 0	(F) 7	(G) 9	(H) 32
20/1p.	$4\%8*8+9\%4$	(A) -24	(B) 0	(C) 4	(D) 5	(E) 15	(F) 29	(G) 33	(H) 36
21/1p.	$0-0*2-7-8$	(A) -15	(B) -8	(C) -1	(D) 1	(E) 8	(F) 15	(G) 74	(H) 94
22/1p.	$1*2-2*5-5$	(A) -53	(B) -13	(C) -5	(D) -3	(E) 0	(F) 2	(G) 41	(H) 86
23/1p.	$9+3-5/6*5$	(A) 0	(B) 4	(C) 5	(D) 8	(E) 12	(F) 24	(G) 40	(H) 60
24/1p.	$4\%8-0+3\%4$	(A) -95	(B) -79	(C) -58	(D) -44	(E) 0	(F) 1	(G) 3	(H) 44
25/1p.	$3+5\%3\%5-1$	(A) -29	(B) -1	(C) 0	(D) 1	(E) 4	(F) 5	(G) 27	(H) 75
26/1p.	$8-2>=5==8-7$	(A) -7	(B) -6	(C) 1	(D) 7	(E) 8	(F) 14	(G) 15	(H) 66
27/1p.	$1+7-6\%3-6$	(A) -89	(B) -64	(C) -25	(D) -7	(E) -4	(F) -1	(G) 14	(H) 91
28/1p.	$4+1!=7>8+7$	(A) -76	(B) 0	(C) 1	(D) 4	(E) 5	(F) 11	(G) 12	(H) 21
29/1p.	$8+3<2>7-4$	(A) -54	(B) -49	(C) -4	(D) -3	(E) 0	(F) 1	(G) 4	(H) 21
30/1p.	$8/4\%5*6+8$	(A) -97	(B) -32	(C) 0	(D) 2	(E) 8	(F) 10	(G) 20	(H) 75
31/1p.	$8/9==0<4*7$	(A) -88	(B) -79	(C) -12	(D) 0	(E) 1	(F) 8	(G) 56	(H) 91

How many times does the body of the loop execute? (Mark 9 if 9 or more.)

32/2p.	<code>int r=3; do body; while(r-- >= 1);</code>
33/2p.	<code>int w=-4; while(w-- != -4) body;</code>
34/2p.	<code>int h=-4; do body; while(h-- != -10);</code>
35/2p.	<code>int z=2; while(z++ != 2) body;</code>
36/2p.	<code>int k; for(k=10; k!=7; k--) body;</code>
37/2p.	<code>int f=-9; while(f++ != -5) body;</code>
38/2p.	<code>int q=-2; while(q++ != -2) body;</code>
39/2p.	<code>int b=-2; while(b-- < 2) body;</code>

40/3p. 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) $n^2\sqrt{n}$ (C) $n\sqrt{n}\lg n$ (E) $n\lg n$ (G) $\sqrt{n}\lg n$ (I) $\lg n$

(B) $n^2\lg n$ (D) $n\sqrt{n}$ (F) n (H) \sqrt{n} (J) 1

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

41/3p. 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) $n^2\sqrt{n}$ (C) n^2 (E) $n\sqrt{n}$ (G) $\sqrt{n}\lg n$ (I) $\lg^2 n$

(B) $n^2\lg n$ (D) $n\sqrt{n}\lg n$ (F) $n\lg n$ (H) \sqrt{n} (J) 1

```
int main ( int argc, char * * argv ) {
    int n = atoi(argv[1]);
    if ( simpleCompare ) {
        c = 1; do {
            for ( h = 1 ; h * h < n ; h++ ) {
                simpleStatement;
            }
            c *= 2; } while ( c < n );
    } else {
        simpleStatement;
    }
    return 0; }
```

42/3p. 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) $n^2\sqrt{n}$ (C) n^2 (E) n (G) \sqrt{n} (I) $\lg n$

(B) $n^2\lg n$ (D) $n\sqrt{n}\lg n$ (F) $\sqrt{n}\lg n$ (H) $\lg^2 n$ (J) 1

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

- 43/5p. 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) $n^2 \lg n$ (C) $n\sqrt{n}$ (E) n (G) \sqrt{n} (I) $\lg n$
 (B) n^2 (D) $n \lg n$ (F) $\sqrt{n} \lg n$ (H) $\lg^2 n$ (J) 1

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

- 44/5p. 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^6 (C) $n^5 \lg n$ (E) $n^4 \sqrt{n} \lg n$ (G) $n^3 \lg^4 n$ (I) $n^2 \lg^3 n$
 (B) $n^5 \sqrt{n} \lg n$ (D) n^5 (F) $n^3 \sqrt{n} \lg n$ (H) $n^2 \sqrt{n} \lg^2 n$ (J) $\sqrt{n} \lg n$

```
int main ( int argc, char * * argv ) {
  int n = atoi(argv[1]);
  a = n; do {
    for ( c = 1 ; c * c < n ; c++ ) {
      j = n; while ( j > 1 ) {
        for ( i = 1 ; i * i < n ; i++ ) {
          k = 1; do {
            g = 1; while ( g * g < n ) {
              e = 1; do {
                simpleStatement;
              } while ( e < n );
            } while ( e < n );
            g += 1; }
          k++; } while ( k * k < n );
        }
        j -= 2; }
    }
  a--; } while ( a > 1 );
  return 0; }
```

45/5p. 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^4 (C) $n^3 \lg n$ (E) $n^2 \lg n$ (G) $\sqrt{n} \lg^3 n$ (I) $\lg^2 n$
 (B) $n^3 \sqrt{n}$ (D) $n^2 \lg^2 n$ (F) n^2 (H) \sqrt{n} (J) $\lg n$

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

Matching: Which Perl regular expression commands have what meaning? (If no match mark J.)

(A) * (B) + (C) [(D) \B (E) \D (F) \S (G) \s (H)] (I) {

- 46/1p. end of character class
- 47/1p. start of character class
- 48/1p. non whitespace
- 49/1p. digit
- 50/1p. repeat zero or more times

True or False: does the string match the regular expression?

- 51/1p. Does the string "zuz" match the regular expression "z+uz"?
- 52/1p. Does the string "hyg" match the regular expression "h*yg"?
- 53/1p. Does the string "rrrrfy" match the regular expression "(rr+|fy)?"?
- 54/1p. Does the empty string match the regular expression "nd+(st)?"?
- 55/1p. Does the string "gttzw" match the regular expression "gf+t+zw"?
- 56/1p. Does the string "hn" match the regular expression "(hn)?"?
- 57/1p. Does the string "bgbg" match the regular expression "(ff|bg+)"?
- 58/1p. Does the empty string match the regular expression "(bg)*|s?|kb"?
- 59/1p. Does the string "tuuqz" match the regular expression "tu+(qz)*"?
- 60/1p. Does the string "rzkn" match the regular expression "(bd|rz|k(na)*)*?"?
- 61/1p. Does the string "phqsrphun" match the regular expression "p+|hq|sr(ph)?|un"?
- 62/1p. Does the string "sh" match the regular expression "x+|sh|ra+(dx)?|ng"?

Total points 100.

Answer Key (points per line)

1 (2).	D	32 (2).	4
2 (2).	I	33 (2).	0
3 (2).	C	34 (2).	7
4 (2).	E	35 (2).	0
5 (2).	I	36 (2).	3
6 (2).	G	37 (2).	4
7 (2).	C	38 (2).	0
8 (2).	D	39 (2).	9
9 (2).	C	40 (3).	$H(\sqrt{n})$
10 (2).	A	41 (3).	$G(\sqrt{n} \lg n)$
11 (2).	I	42 (3).	$G(\sqrt{n})$
12 (2).	F	43 (5).	$C(n\sqrt{n})$
13 (1).	F (5)	44 (5).	$D(n^5)$
14 (1).	E (4)	45 (5).	$D(n^2 \lg^2 n)$
15 (1).	E (1)	46 (1).	H
16 (1).	C (1)	47 (1).	C
17 (1).	J (0)	48 (1).	F
18 (1).	D (1)	49 (1).	J
19 (1).	G (9)	50 (1).	A
20 (1).	G (33)	51 (1).	true
21 (1).	A (-15)	52 (1).	true
22 (1).	B (-13)	53 (1).	false
23 (1).	E (12)	54 (1).	false
24 (1).	J (7)	55 (1).	false
25 (1).	E (4)	56 (1).	true
26 (1).	C (1)	57 (1).	true
27 (1).	J (2)	58 (1).	true
28 (1).	C (1)	59 (1).	true
29 (1).	E (0)	60 (1).	false
30 (1).	G (20)	61 (1).	false
31 (1).	D (0)	62 (1).	true

Total points 100.