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| **2017-2018** | **ACSL** American Computer Science League | **All-Star Contest** |

**Senior Division**

**Instructions for Short Round Questions**

1. **MATERIALS ALLOWED**

* Plain paper and pencils
* No calculators, headphones or any type of electronic device

1. **SCORE SHEETS**

* Only use pencils to mark the answers.
* Put your name, your grade, your school name and your division on the scoresheet as shown below:



* No erasures are allowed – use an additional score sheet if necessary.
* There will be no appeals based upon answer sheet errors.

1. **STUDENT PROCEDURES**

* Keep your eyes on your own paper.
* Keep answer sheet and scrap paper guarded.
* You must stay in the room until the end of the test.
* You can keep all materials at the end.
* The time limit is 60 minutes.

1. **TEST ANSWERS**

* Proctors will read the letter answers at the end of the testing period.
* Appeals in writing must be brought to the scoring room no later than 3:30 PM. The appeal must show your detailed solution.

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| 1. Boolean Algebra   How many ordered quadruples make the following  Boolean expression FALSE? | 1. 4 2. 6 3. 8 4. 10 5. None of the above |
| 1. Bit-String Flicking   How many different values of x (a bitstring of 6 bits) make the  following equation TRUE?  (x OR 110110 AND x) = (LSHIFT-1 x) | 1. 1 2. 2 3. 4 4. 8 5. None of the above |
| 1. Recursive Functions   Find  given:    Note :  represents the greatest integer less than or equal to x | 1. 6 2. 7 3. 9 4. 10 5. None of the above |
| 1. Digital Electronics   Define the following new gates: A *diamond* has 3 inputs and is TRUE if only 1 input is TRUE, an *oval* has 3 inputs and is TRUE if at most 1 input is TRUE, and a *rectangle* has 3 inputs and is TRUE if all inputs are TRUE. How many ordered quadruples make the following circuit TRUE? | 1. 1 2. 3 3. 9 4. 13 5. None of the above |
| 1. Prefix-Infix-Postfix   Define a # b = a2 − ab + b2  Evaluate this prefix expression. Note: all numbers are single digits.  + − / \* 3 # # 0 2 2 \* 2 3 / # 4 − 8 6 \* 3 2 ↑ 2 4 | 1. 15 2. 20 3. 38 4. 56 5. None of the above |
| 1. Computer Number Systems   How many numbers from 100 to 400 in base 10 consist of distinct  ascending digits and also have distinct ascending hex digits when  converted to base 16? | 1. 13 2. 14 3. 23 4. 25 5. None of the above |
| 1. What Does This Program Do?   What value is output when the following program is executed?  for x = 0 to 4  for y = 0 to 4  A(x,y) = (x+1) ^ 2 + y  next y  next x  for x = 0 to 4  for y = 0 to 4  if A(x,y) % 3 == 0 then  A(x,y) = A(x,y) / 3  if A(x,y) % 4 == 0 then  A(x,y) = A(x,y) / 4  if A(x,y) % 5 == 0 then  A(x,y) = A(x,y) / 5  next y  next x  s = 0  for x = 0 to 4  for y = 0 to 4  if A(x,y) % 2 == 0 then  s = s + A(x,y)  next y  next x  output s | 1. 7 2. 20 3. 48 4. 58 5. None of the above |
| 1. Data Structures     Consider all binary search trees with 32 nodes. What is the  smallest value for the internal path length? | 1. 98 2. 103 3. 108 4. 135 5. None of the above |
| 1. Graph Theory     Given the following directed graph  of airports and the flights available  among them, how many flights  from ATL to ORD have at most 2  intermediate stops? (No airport  may be visited twice.) | 1. 8 2. 9 3. 13 4. 16 5. None of the above |
| 1. LISP   Evaluate the following sequence of Lisp functions:  (SETQ U ‘((a (b c)) (d e f) (g) (h (i j k)) (l m) n))  (SETQ V ‘(p (q r) (s (t u v)) (w (x y) z)))  (SETQ X (CDR (CAR (CDR (CDR V)))))  (SETQ Y (CAR (CDR (CAR (CDR (CDR (CDR U)))))))  (REVERSE (CONS Y X)) | 1. ((t u v) (i j k)) 2. (t u v (i j k)) 3. (t u v i j k) 4. ((t u v) i j k) 5. None of the above |
| 1. FSAs and Regular Expressions   List all of the strings that are accepted by the regular expression  ((0  1)\* (11  00) 1\*100\*)\*  a. 0001111101  b. 11111111111111  c.  d. 0101010101010101  e. 001011101111111110  f. 000010000000000000  g. 111111111111101111 | 1. a, d, e, g 2. a, c, e, f, g 3. b, c, d, f, g 4. c, e, f, g 5. None of the above |
| 1. Assembly Language   What is the final value printed when this program is executed?  NUM DC 24 STORE NUM  CNT DC 0 BU START  START LOAD NUM CONT LOAD NUM  SUB =1 DIV =2  BE DONE STORE NUM  LOAD CNT BU START  ADD =1 DONE PRINT CNT  STORE CNT END  LOAD NUM  DIV =2  MULT =2  SUB NUM  BE CONT  LOAD NUM  MULT =3  ADD =1 | 1. 8 2. 10 3. 12 4. 16 5. None of the above |