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| **2016-2017** | **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**

* Use pencils only to mark the answers.
* Put your name, school name, grade and division on the back of the scoresheet.
* 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 sheets 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   Simplify the following expression: | 5. None of the above |
| 1. Bit-String Flicking   Let X = abcde and NOT X = ABCDE. What is the final value of X?  FOR I = 1 TO 3  X = (RCIRC-2(RSHIFT-1 X)) OR (NOT(RCIRC-3 X))  NEXT I | 1. 01E01 2. 11E11 3. e01E0 4. 11011 5. None of the above |
| 1. Recursive Functions   Find (5,6) given the following definition: | 1. 8 2. -3 3. -8 4. 13 5. None of the above |
| 1. Digital Electronics   How many ordered triples make this circuit TRUE? | 1. 8 2. 4 3. 2 4. 1 5. None of the above |
| 1. Prefix-Infix-Postfix   Given the following operations: % means MOD (integer remainder) such  that 5%2 = 1 and \ means DIV (integer quotient) such that 5\3 = 1, evaluate  the following prefix expressions if A=5, B=12, C=8, and D=20. Note that all  numbers in the original expression are single digits.  / - ^ \ \* C - - D A B A \ ^ % + A C - D B 2 7 1 - B % B A | 1. 6.4 2. 6.3 3. 63 4. 3.6 5. None of the above |
| 1. Computer Number Systems   Tickets for a concert were numbered from 116 to AA16. If when the ticket  number is converted to binary it contains the string “10101”, then the lucky  ticket holders will receive a Back Stage Pass for after the concert. How  many (one pass per winning ticket) passes were given out if the concert was  sold out? | 1. 13 2. 15 3. 45 4. 49 5. None of the above |
| 1. What Does This Program Do?     What is the output for the following program?  DIM S(5,5): REM ALL VALUES START AT 0  A = -15: D = 2: R = 1: C = 3  S(R,C) = A  FOR X = 2 TO 25  A = A + D  IF( R = 1) AND (C = 5) THEN  R = R + 1  ELSE  R = R - 1  IF R = 0 THEN R = 5  C = C + 1  IF C = 6 THEN C = 1  IF S(R,C) <> 0 THEN C = C - 1 : R = R + 2  END IF  S(R,C) = A  NEXT X  FOR X = 1 TO 5  V = V + S(X,X)  W = W + S(X,6-X)  NEXT X  PRINT V + W  END | 1. 80 2. 45 3. -30 4. 100 5. None of the above |
| 1. Data Structures   Given the binary search tree for LOSANGELESCA, delete the root node.  List the nodes at depth 3 from left to right. | 1. A, G 2. E, O 3. E, L 4. C, N, S 5. None of the above |
| 1. Graph Theory   In a directed graph, the paths represent streets from one intersection to  another. The intersections are: {A, B, C, D, E, F, G}. The streets are:  {AB, BF, EF, CD, ED, DC, EB, FA, GF, FE, BE, CE, GA, FG, AG, FB}.  A new one-way street was added from B to C and the two-way street  between F and G was closed due to non-use. What was the change in the  number of cycles from A between the first directed graph and the second one? | 1. 1 fewer 2. 2 more 3. 2 fewer 4. No change 5. None of the above |
| 1. LISP   Evaluate the following expression if  X = ‘((a (b)) c (d e f)) and Y = ‘((a b) (c) (d e) f)  (CAR (CDR (CDR (CDR (REVERSE (CONS (CAR X) (CDR Y))))))) | 1. ((b)) 2. (a (b)) 3. (b) 4. a 5. None of the above |
| 1. FSAs and Regular Expressions   A company wants its employees to create new types of email addresses using  the regular expression below. Which of the addresses is/are valid?  Define: [A-J] indicates uppercase letters from A to J inclusive, [0-5] indicates a  digit from 0 to 5 inclusive, (a/b/c) indicates a or b or c, and {@} indicates the  special character between the { }’S.  [A-A] [A-Z]\* [1-9] [0-9]\* [A-Z] [A-M]\* [H-Z]\*  {@} (A/C/S/L)\* (U/C) {.} (A/C/S/U)\*  Possible email addresses: i) ACSL1978RI@AU.ACS  ii) AC2017C@L.CCC  iii) ANDREW3DEAN@UL.UU  iv) A0ACSL@LU.ACC  v) ARICSL78@CC.AC  vi) ACSL39YRS@AU.ACSU  vii) A20162017CSL@LC.A  viii) ACOMPSCI500LEAGUE@LU.ACSL | 1. i, v, vii 2. ii, vii, viii 3. iii, iv, vii 4. i, vi, vii 5. None of the above |
| 1. Assembly Language   What is printed when the following program is run if the data is:  55, 70, 60, 60, 40, 80, 25, 90, 30, 0?  A DC 1000 X LOAD C  B DC 0 STORE A  TOP READ C BU M  LOAD C Y LOAD C  BE Z STORE B  SUB A BU TOP  BL X Z LOAD B  M LOAD C SUB A  SUB B STORE W  BG Y PRINT W  BU TOP END | 1. 60 2. 55 3. 70 4. 65 5. None of the above |