American Computer Science League

Box 40118 · Providence, RI 02940 · 401 822–4312

The American Computer Science League (ACSL) is a non-profit organization devoted to computer science education at the secondary school level. The purpose of this flier is to tell you about the organization, and to invite your school to participate in it.

ACSL administers computer science contests for junior and senior high school students, publishes a newsletter containing the results of each contest and items of interest, and awards prizes (computers, books, and trophies) to outstanding students and schools at local and regional levels. This past year, our 17th year of operation, about 250 schools in the United States and Canada participated. In addition, a handful of teams from Croatia and Japan partipated in ACSL last year.

ACSL will provide a unique and exciting educational opportunity for your school's computer enthusiasts. Contest problems motivate students to study computer topics not covered in their school's curriculum and to pursue classroom topics in depth. At many schools, the League is the focal point both for extracurricular clubs and for entire courses.

Contests are held at each participating school thereby eliminating the need for travel, and an unlimited number of students from all grade levels may compete at each school. A school's score is the sum of the scores of its three or five highest-scoring students. In each competition, students are given short theoretical and applied questions, and then a practical problem to solve within the following three days, testing it on our data using their school's computer facilities. After the contest is administered by the faculty advisor, each school's results are returned to ACSL for tabulation. At the end of the year, an Invitational Team All-Star Contest is held at a common site.

The Classroom Division consists of only pencil and paper questions; there are no programming problems. This division is open to all students from all grades not competing in any other division; prizes are awarded on a grade-by-grade basis.

The *National Association of Secondary School Principals* (NASSP) has placed ACSL on the National Advisory List of Contests and Activities. However, the Team All-Star Contest, sponsored by ACSL's parent organization, is not because it requires travel to a common site and has a separate registration fee.

Since much of the contest material is new to most faculty advisors, complete study materials, sample problems, and annotated solutions to contest problems are provided upon registration. A few sample contest problems and solutions appear elsewhere in this flier.

Please refer to the registration form in this flier for membership fees and the availability of previous years' contest materials.

1994–95 PRIZES

Compaq Computer Corp. donated 4 Compaq Pro Linea 4/100 multimedia computer systems; **Allstar Systems** of Houston donated one Compaq DeskPro XE computer system; and the international accounting firm of **Cooper–Lybrand** presented a $4,000 gift certificate for the purchase a computer system. **Microsoft** donated 12 copies of Visual Basic, Visual C++, and Microsoft Office Pro.

The computers, gift certificate, and the software were awarded to the top schools in each division at the Team All-Star Contest, held at Cypress Creek HS in Houston.

Microsoft also donated 50 copies of *Isaac Asimov's The Ultimate Robot* CD-ROM; these were awarded to top students at the All-Star Contest. Also at the All-Star Contest, trophies were awarded to top teams in each division and to each team member of those schools. Books, donated by **Addison-Wesley**, **MIT Press**, and **Prentice Hall**, were awarded to top scoring students by grade.

During the regular season, trophies were awarded to the top teams and the top individuals in each regional area of each division. Finally, each team received an award to present to an outstanding student at the advisor's discretion.

ACSL thanks these sponsors for their generous contributions.

1995–96 CONTEST DATES

The last date on which each contest may be given:

Contest #1 ..... Friday, December 8, 1995
Contest #2 ..... Friday, February 2, 1996
Contest #3 ..... Friday, March 1, 1996
Contest #4 ..... Friday, April 5, 1996
Team All-Star Contest... Saturday, May 25, 1996

ABOUT THE SAMPLE PROBLEMS

Each contest in the Junior, Intermediate, and Senior divisions consists of Short Problems and a Programming Problem. The Short Problems contain 5 problems from designated topics, worth one point apiece, and students are given 30 minutes in which to solve the problems. The Classroom Division consists of Short Problems only: 10 problems to be solved in 45 minutes.

The categories used for the Short Problems, although new to most students and advisors, can be easily taught in one class period using the explanations provided with registration materials. Most advisors find that reviewing problems used in previous years' contests is a great way to prepare students for future contests. Previous years' contest materials are available; see the registration form.

The Programming Problem has 5 outputs worth one point each. The Programming Problem is to be completed within a 72 hour period. Students may use any computer (in school or out of school), any language, and as much computer time as desired. The Programming Problems are designed so that the first few outputs are easily programmed and that succeeding outputs are more challenging. Our intent is to provide a successful and rewarding experience for students of varying programming ability.

Because of space limitations, only the outputs to the sample programming problems are printed here. Sample programming solutions—written by students—are printed in each contest's follow-up newsletter.

SAMPLE PROBLEMS

PROGRAMMING PROBLEM — Jr./Int. Divisions

Problem: A parking garage charges 50 cents through the first 30 minutes, 35 cents for each additional half-hour through the first 8 hours, and a quarter for each additional half-hour after the first 8 hours.

For example, if a car has been parked in the garage for 580 minutes, the fee is $6.75: $0.50 for the first half-hour, $0.35/half-hour for the next 15 half-hours, and $0.25/half-hour for the last 4 half-hours.

Input/Output: Given the number of minutes that four cars have been parked, calculate the fee for each car.

Test Data: 20, 120, 240, 625

Solutions: .50, 1.55, 2.95, 7.00

PROGRAMMING PROBLEM — Int./Sr. Divisions

Problem: Find the least common multiple (LCM) and the greatest common factor (GCF) of a set of numbers.

Input/Output: Given four positive integers, a, b, c and d, each less than 100, output the following:

1. The LCM of a and b.
2. The LCM of c and d.
3. The GCF of a and c.
4. The GCF of b and d.
5. The LCM of a,b, and c.

Test Data: 18, 30, 54, 12

Solutions: 90, 108, 18, 6, 270

WHAT DOES THIS PROGRAM DO? — Jr./Int.

Problem: When this program is run, what is the third number printed?

```
10 data 8.314, 26.884, 4.238, 0.965, 0, 8.63
20 rem
30    read A
40    if A = 0 then 70
50    print (int(A*100 + .5) / 100)
60 goto 20
70 end
```

Solution: This program reads numbers until a zero is reached. Each number is printed after it is rounded to the nearest hundredth by multiplying the number by 100, adding 0.5 to it, and diving the integer part by 100. The third number, 4.238, becomes 4.24 when rounded.

COMPUTER NUMBER SYSTEMS — Jr./Int.

Problem: Convert 101011001110_2 into base 16.

Solution: Write the binary number by grouping every four digits from the right:

$$1010\,1100\,1110$$

Convert each group into a hexadecimal digit:

$$\begin{aligned} 1010_2 &= 10_{10} = \mathrm{A}_{16} \\ 1100_2 &= 12_{10} = \mathrm{C}_{16} \\ 1110_2 &= 14_{10} = \mathrm{E}_{16} \end{aligned}$$

Thus, $1010\,1100\,1110_{\ 2} = \mathrm{ACE}_{16}$.

ANALYSIS OF ALGORITHMS — Int./Sr.

Problem: When the following program is run, how many times is *Line 50* executed?

```
10 data 3, 5, 7, 9, 11, 2, 4, 4, 10, 11
20 for J=1 to 5
30   read A(J), B(J)
40   if A(J) >= B(J) then 60
50     X=A(J): A(J)=B(J): B(J)=X
60   rem
70 next J
```

Solution: This program reads data into arrays A and B and swaps $A(J)$ with $B(J)$ if the Jth element of A is less than the corresponding element of array B:

J	$A(J)$	$B(J)$	$swap$?
1	3	5	YES
2	7	9	YES
3	11	2	NO
4	4	4	NO
5	10	11	YES

The table above shows the swap on *Line 50* is executed 3 times: for the first, second and fifth elements.

PREFIX/INFIX/POSTFIX — Int./Sr.

Problem: Evaluate the following prefix expression:

$$*\ -\ 19\ +\ 78$$

Solution: The expression converts to infix as follows:

$$*\ -\ 8\ +\ 78 \Rightarrow *\ -\ 8\,15 \Rightarrow -120$$

REGISTRATION FORM

American Computer Science League
Box 40118 · Providence, Rhode Island 02940

All fees are in US dollars. Payment or a purchase order must accompany all orders.

Advisor _____

School _____

School Address: Street _____

City _____ State/Province _____

Zip/Postal Code _____ Country _____

School Phone: Area Code _____ Tel. _____

Home Phone: Area Code _____ Tel. _____

Electronic mail address: _____

Registration: See the "DIVISIONS" section for more information.

☐ Classroom
☐ Senior/5
☐ Senior/3
☐ Intermediate/5
☐ Intermediate/3
☐ Junior/5

____ 1 team ($125)
____ 2 teams ($225)
____ 3 teams ($300)
____ 4 teams ($350)

Previous Years' Contest Books:

☐ A. Sr., Int., and Jr. 1994-95 ($20)
☐ A. Sr., Int., and Jr. 1992-94 ($25)
☐ C. Sr., Int., and Jr. 1990-92 ($20)
☐ D. Sr., Int., and Jr. 1988-90 ($20)
☐ E. Junior 1981-88 ($30)
☐ F. Intermediate 1983-88 ($25)
☐ G. Senior 1978-88 ($35)

TOTAL PAYMENT DUE: ☐

DIVISIONS

The American Computer Science League consists of four divisions to appeal to the varying computing abilities and interests of students.

- The *Senior Division* is geared to those high school students with experience programming computers, especially those taking a Computer Science AP course. We suggest that schools do not register for the Senior Division during their first year of ACSL participation.
- The *Intermediate Division* is geared to senior high school students with little or no computer programming experience, and to advanced junior high students.
- The *Junior Division* is geared to junior high and middle school students with no previous experience programming computers.
- The *Classroom Division* is open to students from all grades. It consists of a selection of the non-programming problems from the other three divisions. As its name implies, this division is particularly well-suited for use in the classroom.

We encourage schools to join more than one division so that novice students are not intimidated by the material, nor are advanced students bored. All divisions cover similar material, but in varying levels of detail and difficulty. Team scores and individual scores cannot be transferred between divisions.

The Senior and Intermediate divisions allow 5-person and 3-person teams. (School must choose one or the other at registration, since scores are not transferred between the divisions.) Teams compete for prizes and invitations to the All-Star Contest against same-sized teams; students will compete for individual awards independent of the team size. A school may not register both a 5-person team and a 3-person team in the same division.

EXECUTIVE COMMITTEE

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