

26th Annual Symposium  
on  
Foundations of Computer Science

Portland, Oregon  
October 21-23, 1985

The symposium is sponsored by the IEEE Computer Society Technical Committee for Mathematical Foundations of Computing in cooperation with the ACM Special Interest Group for Automata and Computability Theory.\*

\* Cooperation is subject to approval by ACM

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## INFORMATION

### PORTLAND

The Coastal Range to the west and the snowcapped Cascades to the east, the majestic Columbia River and the serene Willamette, recollections of a pioneer heritage, fountains, forests, sculpture, carrousel, galleries, and roses, every view of Portland is the right one. You'll find the 26th FOCS is right in the city, within walking distance of fine restaurants, shops, theatres, but it is right on the riverbank as well, near parks, esplanades, and jogging paths.

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### LOCATION

The technical session, business meeting, reception and lunches will all be at the Portland Marriott. The Marriott is located downtown at 1401 S.W. Front Avenue, one block south of the Hawthorne Bridge, on the west bank of the Willamette River. The Tuesday evening banquet-cruise will be on Portland's new sternwheeler "Columbia Gorge", built to the classic specifications of the 19th century "darlings" of these waterways. The sternwheeler will be berthed within a short walk from the Marriott.

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### CLIMATE

Portland's weather is mild. High temperature in October is likely to be in the low 60's, low in the 40's. On Portland's precipitation, natives have observed, "If you can't see Mt. Hood, it's raining, if you can, it's about to rain." On the other hand, rain, if any, is likely to be light and intermittent; anyway, in the dry moments, you'll appreciate rain's legacy in the clean air and lush vegetation.

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### GETTING THERE

Served by 13 airlines, Portland International Airport is within a twenty minute drive of downtown. Transportation to the Marriott is available through "Airporter" bus, taxi, or Tri-Met bus. Frequent "Airporter" bus service to downtown hotels leaves every 20 minutes; access is well-marked; also several terminal phones offer direct dial to the "Airporter" for information on the next bus; cost: \$4.00 (one way). Taxi fare is about \$17 via Freeway and about \$14 via Sandy Blvd. (Sandy Blvd. is shorter route but Freeway is faster). Tri-Met bus service is the cheapest of all but is longer and requires a transfer; take the 72 bus to Sandy Blvd. and transfer to the 14 bus; buses run every 20 minutes; cost: \$.75 .

If you are driving, exit Interstate 5 at "City Center" and follow signs to "Front Avenue".

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## AIR TRAVEL TIPS

United Airlines has been designated as the official carrier of FOCS 1985. As a benefit, you can obtain a 35% discount from United's unrestricted Day Coach fare OR a 15% discount from the United's Easy Saver fare (requiring a Saturday night stay). For reservations, and other information, call United at 1-800-521-4041 (your travel agent may make the call). Be sure to mention FOCS and to give the FOCS account number 562T.

The lowest available airfares, through any carrier, are usually of the super-saver type. Typical restrictions may include a 30 day advanced purchase and stay over Saturday night (check out our pre-FOCS Sunday excursions - you'll find a Saturday arrival well worthwhile). Note, though, that there is limited availability of these fares so don't expect to get what you want if you call exactly 30 days in advance. (Suggestion: call NOW).

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## TOURIST INFORMATION

Suggestions on what-to-see, what-to-do will be available at the registration desk. For trip-planning in the great Pacific Northwest, you may want to call: 1-800-233-3306 (Oregon info.) and 1-800-541-9274 (Washington info.)

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## MACHTEY AWARD

The Machtey Award is presented for the most outstanding paper written by a student or students, as judged by the program committee. It includes a grant to help defray authors' expenses in attending the FOCS Symposium. Please consider a donation to the Machtey Award fund to foster this tradition. You may include the donation with your registration form. A receipt will be provided for tax purposes.

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## ACKNOWLEDGEMENTS

Student luncheons are being subsidized by a generous gift from Tektronix Laboratories.

A reduction in student fees was made possible through the industrial affiliates of SIGACT and the Technical Committee who support both STOC and FOCS.

Local arrangements support is being provided by Tektronix Laboratories and by the Departments of Computer Science and Electrical Engineering at Portland State University.

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## CONFERENCE INFORMATION

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Program Committee:  
Manuel Blum, John Hopcroft, Tom Leighton, Jeff Lagarias,  
Michael O'Donnell, Charles Rackoff, Larry Ruzzo, Larry Stockmeyer,  
Bob Tarjan, Frances Yao

## SCHEDULE

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### EXCURSIONS. Sunday, October 20

For those who will have arrived in Portland by Sunday morning, there is a choice of excursions unique to the Pacific Northwest.

Excursion A. Mount St. Helens scenic flight  
Groups leave hotel 9am, 11am, and 1pm; 2 hour round trip

After more than a century of slumber, Washington's Mt. St. Helens awoke with a blast on May 18, 1980. The massive eruption hurled ash and debris over twelve miles skyward. The resulting cloud circled the earth and in some areas turned day into night as it deposited more than a foot of ash. From the comfort and safety of the aircraft you will view firsthand the steaming crater and mudflows of the only active volcano on the American continent. Photographic opportunities abound. Flight time is about an hour and fifteen minutes. Weather permitting (full refund if trip is rained out). Price: \$38. Payment must accompany preregistration.

Excursion B. The Columbia River Gorge - afoot  
Leave hotel at 8am, return about 3pm

This magnificent area is a lovely blend of gently flowing streams, cascading waterfalls and spectacular cliffs. Autumn brings a new character to "The Gorge" as the foliage is changing and the air is cool and crisp. You'll be transported by van to the trailhead at the top of Larch Mountain. From this point, on a clear day, views include Mt. Hood and Mt. St. Helens. You will be guided on a downhill hike, along an enchanting forest trail, to Multnomah Falls. The van will be waiting at trail's end. Weather is not a deterrent, the Gorge is even more beautiful through a drizzle (rain gear will be provided, if needed). Price: \$25 (includes box lunch). Payment must accompany preregistration.

SESSION 1. Monday Morning, October 21  
 Chair: Manuel Blum  
 Univ. of California, Berkeley  
 Salon F, Level LL1

- 8:30 am Separating the Polynomial-Time Hierarchy by Oracles  
 Andrew Chi-Chih Yao, Stanford Univ.
- 8:50 am Deterministic Simulation of Probabilistic Constant Depth Circuits  
 Avi Wigderson and Miklos Ajtai, IBM Research, San Jose
- 9:10 am Amplification of Probabilistic Boolean Formulas  
 Ravi B. Boppana, MIT
- 9:30 am On Networks of Noisy Gates  
 Nicholas Pippenger, IBM Research, San Jose
- 9:50 am How Easy is Local Search?  
 Christos H. Papadimitriou, Stanford Univ. and NTU Athens, and David S. Johnson and Mihalis Yannakakis, AT&T Bell Labs
- 10:10 am Coffee Break - Foyer
- 10:30 am Identification Is Easier Than Decoding  
 Joseph Ja'Ja', Univ. of Maryland
- 10:50 am Three Theorems on Polynomial Degrees of NP-Sets  
 Klaus Ambos-Spies, Universitat Dortmund
- 11:10 am Simulating Two Pushdown Stores by One Tape in  $O(n^{1.5})$  Time  
 Ming Li, Cornell Univ.
- 11:30 am Nondeterministic versus Probabilistic Linear Search Algorithms  
 Friedhelm Meyer auf der Heide, IBM Research, San Jose
- 11:50 am The Complexity of Facets Resolved  
 David Wolfe, Cornell Univ., and Christos H. Papadimitriou, Stanford Univ. and NTU Athens
- 12:10 pm Lunch - Salon E

SESSION 2. Monday Afternoon, October 21  
 Chair: Frances Yao, Xerox PARC  
 Salon F

<Beverages provided in Foyer from 3:00 to 4:30>

- 2:00 pm Using Dual Approximation Algorithms Scheduling Problems: Theoretical & Practical Results  
 Dorit S. Hochbaum, Univ. of California, Berkeley and David B. Shmoys, Harvard Univ.
- 2:20 pm A Scaling Algorithm for Weighted Matching General Graphs  
 Harold N. Gabow, Univ. of Colorado
- 2:40 pm An All Pairs Shortest Path Algorithm with Expected Running Time  $O(n^2 \log n)$   
 Tadao Takaoka, Ibaraki Univ., and Alistair Moffat, Univ. of Canterbury, New Zealand
- 3:00 pm Recognizing Circle Graphs in Polynomial Time  
 Kenneth J. Supowit and Csaba P. Gabor, Princeton Univ., and Wen-Lian Hsu, Northwestern Univ.
- 3:20 pm Why Certain Subgraph Computations Require  $O(n^2)$  Linear Time  
 A. L. Wong, M. W. Bern and E. L. Lawler, Univ. California, Berkeley
- 3:40 pm Efficient String Matching in the Presence of Errors  
 Gad M. Landau, Tel-Aviv Univ., and Uzi Vishkin, NYU and Tel-Aviv Univ.
- 4:00 pm The Least Weight Subsequence Problem  
 D. S. Hirschberg and L. L. Larmore, Univ. California, Irvine
- 4:20 pm Motion Planning in the Presence of Moving Obstacles  
 John H. Reif, Harvard Univ., and Micha Sharir, Tel-Aviv Univ.
- 4:40 pm Visibility-Polygon Search and Euclidean Short Paths  
 Hiroshi Imai, Univ. of Tokyo, Tetsuo Asano, Osaka Electro-Communication Univ., Takao Asaoka, Sophia Univ., Tokyo, Leo Guibas, DECSRC, and John Hershberger, Stanford Univ.
- 5:00 pm Slimming Down Search Structures: A Functional Approach to Algorithm Design  
 B. Chazelle, Brown Univ.
- 5:20 pm The Complexity of Recognizing Polyhedral Scenes  
 Christos H. Papadimitriou, Stanford Univ. and NTU Athens, and Lefteris Kirousis, Univ. of Patras and NTU Athens
- 9:00 pm Business Meeting - Salon F

SESSION 3.	Tuesday Morning, October 22 Chair: Tom Leighton, MIT Salon F	SESSION 4.	Tuesday Afternoon, October 22 Chair: Michael J. O'Donnell, Univ. of Chicago Salon F
8:30 am	Layer Changes in VLSI Alok Aggarwal, IBM Research, Maria Klawe, IBM Research, San Jose, David Lichtenstein, Yale Univ., Nathan Linial, Hebrew Univ., and Avi Wigderson, IBM Research, San Jose	<Beverages provided in Foyer from 3:00 to 4:30>	
8:50 am	Area Penalty for Sublinear Signal Propagation Delay on Chip Paul M. B. Vitanyi, Centrum voor Wiskunde en Informatica	2:00 pm	Robin Hood Hashing Pedro Celis, Per-Ake Larson and J. Ian Munro, Univ. of Waterloo
9:10 am	On Information Flow and Sorting: New Upper and Lower Bounds for VLSI Circuits Richard Cole and Alan R. Siegel, NYU	2:20 pm	Dynamic Monotone Priorities on Planar Sets Michael J. Fischer, Yale Univ., and Michael S. Paterson, Warwick Univ.
9:30 am	Solving Tree Problems on a Mesh-Connected Processor Array Mikhail J. Atallah and Susanne E. Hambrusch, Purdue Univ.	2:40 pm	Design and Analysis of Dynamic Huffman Coding Jeffrey Scott Vitter, Brown Univ.
9:50 am	Solving Some Graph Problems with Optimal or Near-Optimal Speedup on Mesh-of-Trees Networks Ming-Deh A. Huang, IBM Research	3:00 pm	Average Case Lower Bounds on the Construction and Searching of Partial Orders Harry G. Mairson, INRIA
10:10 am	Coffee Break - Foyer	3:20 pm	On Minima of Functions, Intersection Patterns of Curves, and Davenport-Schinzel Sequences Ron Livne and Micha Sharir, Tel-Aviv Univ.
10:30 am	Randomized Routing on Fat-Trees Charles E. Leiserson and Ronald L. Greenberg, MIT	3:40 pm	Inferring the Structure of Markov Chain From Its Output Steven Rudich, Univ. of California, Berkeley
10:50 am	Distributed BFS Algorithms Robert G. Gallager and Baruch Awerbuch, MIT	4:00 pm	Automatic Verification of Probabilistic Concurrent Finite-State Programs Moshe Y. Vardi, Stanford Univ.
11:10 am	An Almost Linear Time and $O(n \log(n) + e)$ Messages Distributed Algorithm for Minimum-Weight Spanning Trees Francis Chin and H. F. Ting, Univ. of Hong Kong	4:20 pm	Partial Polymorphic Type Inference is Undecidable Hans-J. Boehm, Rice Univ.
11:30 am	Byzantine Agreement in Constant Expected Time (and Trusting No One) Paul Feldman and Silvio Micali, MIT	4:40 pm	Fixpoint Extensions of First-Order Logic Yuri Gurevich, Univ. of Michigan, and Saharon Shelah, Hebrew Univ.
11:50 am	Geometrical Realizations of Set Systems and Probabilistic Communication Complexity N. Alon, MIT, P. Frankl, CNRS, Paris, and V. Rodl, FJFI, CVUT.	5:00 pm	Equivalences and Transformations of Recursive Definitions B. Courcelle, Universite de Bordeaux
12:10 am	Lunch - Salon E	6:15 pm	Banquet & Cruise - "Columbia Gorge" Sternwheeler, Willamette River

SESSION 5.	Wednesday Morning Chair: Jeff Lagarias, AT&T Bell Labs. Salon F	SESSION 6.	Wednesday Afternoon Chair: Larry Ruzzo, Univ. of Washington Salon F
8:30 am	A Private Interactive Test of a Boolean Predicate and Minimum-Knowledge Public-Key Cryptosystems Stuart Haber, Columbia Univ., Zvi Galil, Columbia Univ. and Tel Aviv Univ., and Moti Yung, Columbia Univ.	<Beverages provided in Foyer from 3:00 to 4:30>	
8:50 am	A Robust and Verifiable Cryptographically Secure Election Scheme Josh D. Cohen and Michael J. Fischer, Yale Univ.	2:00 pm	Ears and Branchings in Parallel L. Lovasz, Eotvos Lorand University, Hungary
9:10 am	Verifiable Secret Sharing and Achieving Simultaneity in the Presence of Faults Baruch Awerbuch, Benny Chor, Shafi Goldwasser and Silvio Micali, MIT	2:20 pm	Parallel Computational Geometry A. Aggarwal, IBM Research, B. Chazelle, Brown Univ., L. Guibas, DECSRC, and C. O'Dunlaing and C. Yap, NYU
9:30 am	The Bit Extraction Problem or t-Resilient Functions Benny Chor, MIT, Joel Fridmann, Univ. of California, Berkeley, Oded Goldreich and Johan Hastad, MIT, Steve Rudich and Romana Smolenski, Univ. of California, Berkeley	2:40 pm	Parallel Tree Contraction and Its Application Gary L. Miller, USC, and John Reif, Harvard Univ.
9:50 am	Collective Coin Flipping, Robust Voting Games and Minima of Banzhaf Values Nathan Linial and Michael Ben-Or, Hebrew Univ.	3:00 pm	Improved Processor Bounds for Algebraic and Combinatorial Problems in RNC Zvi Galil, Columbia Univ. and Tel-Aviv Univ., and Victor Y. Pan, SUNY at Albany
10:10 am	Coffee Break - Foyer	3:20 pm	Optimal Parallel Graph Algorithms for Integer Sorting and Graph Connectivity John H. Reif, Harvard Univ.
10:30 am	Random Polynomial Time is Equal to Slightly-Random Polynomial Time Umesh V. Vazirani, Univ. of California, Berkeley, and Vijay V. Vazirani, Cornell Univ.	3:40 pm	Fast Parallel Computation with Permutation Groups Eugene M. Luks, Univ. of Oregon, and Pierre McKenzie, Universite de Montreal
10:50 am	Unbiased Bits from Weak Sources of Randomness Benny Chor and Oded Goldreich, MIT	4:00 pm	Algebraic Cell Decomposition in NC Dexter Kozen, IBM Research, and Chee-Keng Yap, NYU
11:10 am	Factoring with Cyclotomic Polynomials Eric Bach, Univ. of Wisconsin, and Jeffrey Shallit, Univ. of Chicago	4:20 pm	Fast and Efficient Algorithms for Sequential and Parallel Evaluation of Polynomial Zeros and of Matrix Polynomials Victor Y. Pan, SUNY at Albany
11:30 am	Computing with Polynomials Given by Straight-Line Programs II: Factorization Erich Kaltofen, Rensselaer Polytechnic Inst.	4:40 pm	The Complexity of Parallel Sorting Friedhelm Meyer auf der Heide and Avi Wigderson, IBM Research, San Jose
11:50 am	An Application of Simultaneous Approximation in Combinatorial Optimization Eva Tardos, Res. Inst. for Telecommunications, Hungary, and Andras Frank, Eotvos Lorand University, Hungary	5:00 pm	The Complexity of Parallel Computation on Matroids Richard M. Karp, Univ. of California, Berkeley, Eli Upfal, Stanford Univ., and Avi Wigderson, IBM Research, San Jose
12:10 pm	Lunch - Salon E		

HOTEL RESERVATION FORM

Send completed form to:

FOCS Symposium  
Portland Marriott Hotel  
1401 S.W. Front Avenue  
Portland, OR 97201  
Telephone: (503) 226-7600

Accommodations desired:

Single (1 Bed, 1 Person)	\$56	[ ]
Double (1 Bed, 2 Persons)	\$66	[ ]
Double Double (2 Beds, 2 Persons)	\$66	[ ]
Triple (3 Persons)	\$76	[ ]
Quads (4 Persons)	\$86	[ ]

Student Rates\*

Single	\$42	[ ]
Double	\$42	[ ]
Triple	\$45	[ ]
Quad	\$48	[ ]

\*Limited number of rooms available at special rates for full-time students.

Name \_\_\_\_\_

Address \_\_\_\_\_

City \_\_\_\_\_ State \_\_\_\_\_ Zip \_\_\_\_\_

Arrival date/time \_\_\_\_\_ Departure date/time \_\_\_\_\_

To avoid duplications of reservations, please submit only one form when sharing accommodations with one or more individuals.

Names of Persons Sharing Accommodations

\_\_\_\_\_  
\_\_\_\_\_

Please be sure your reservation reaches the hotel 21 days in advance to insure your accommodations. Otherwise rooms will be provided on a space available basis. For arrival after 6 pm, indicate method of guarantee (or first night's deposit enclosed [ ] ).

Credit Card \_\_\_\_\_ # \_\_\_\_\_ Exp. \_\_\_\_\_

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City \_\_\_\_\_ State \_\_\_\_\_ Zip \_\_\_\_\_



ADVANCE REGISTRATION FORM

Registration fee includes technical sessions, a copy of the proceedings, coffee and beverages during sessions, the Sunday evening reception and three luncheons. The non-student fees include the Tuesday evening banquet-cruise. Advance Registration closes Friday, September 27, 1985. All non-student fees will be \$35 higher after close of advance registration. Requests for refunds will be honored until 9/27/85.

Fees (Check one)	Before 9/27	After 9/27	
Member of SIGACT or IEEE Computer Society	\$125	\$160	\$ _____
Non-members	\$160	\$195	\$ _____
Full-time student (Be sure to bring verification of student status to registration).	\$ 30	\$ 40	\$ _____
Machtey Fund (contribution)			\$ _____
Excursions (mutually exclusive) Sunday, October 20			
A. Mt. St. Helens Scenic Flight		\$38	\$ _____
Guest(s) _____ @ \$38			\$ _____
Please rank choice of times (1-3):			
9 am _____ 11 am _____ 1 pm _____			
B. The Columbia River Gorge - afoot		\$25	\$ _____
Guest(s) _____ @ \$25			\$ _____
TOTAL ENCLOSED			\$ _____

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Dietary restrictions: \_\_\_\_\_ Kosher \_\_\_\_\_ Vegetarian