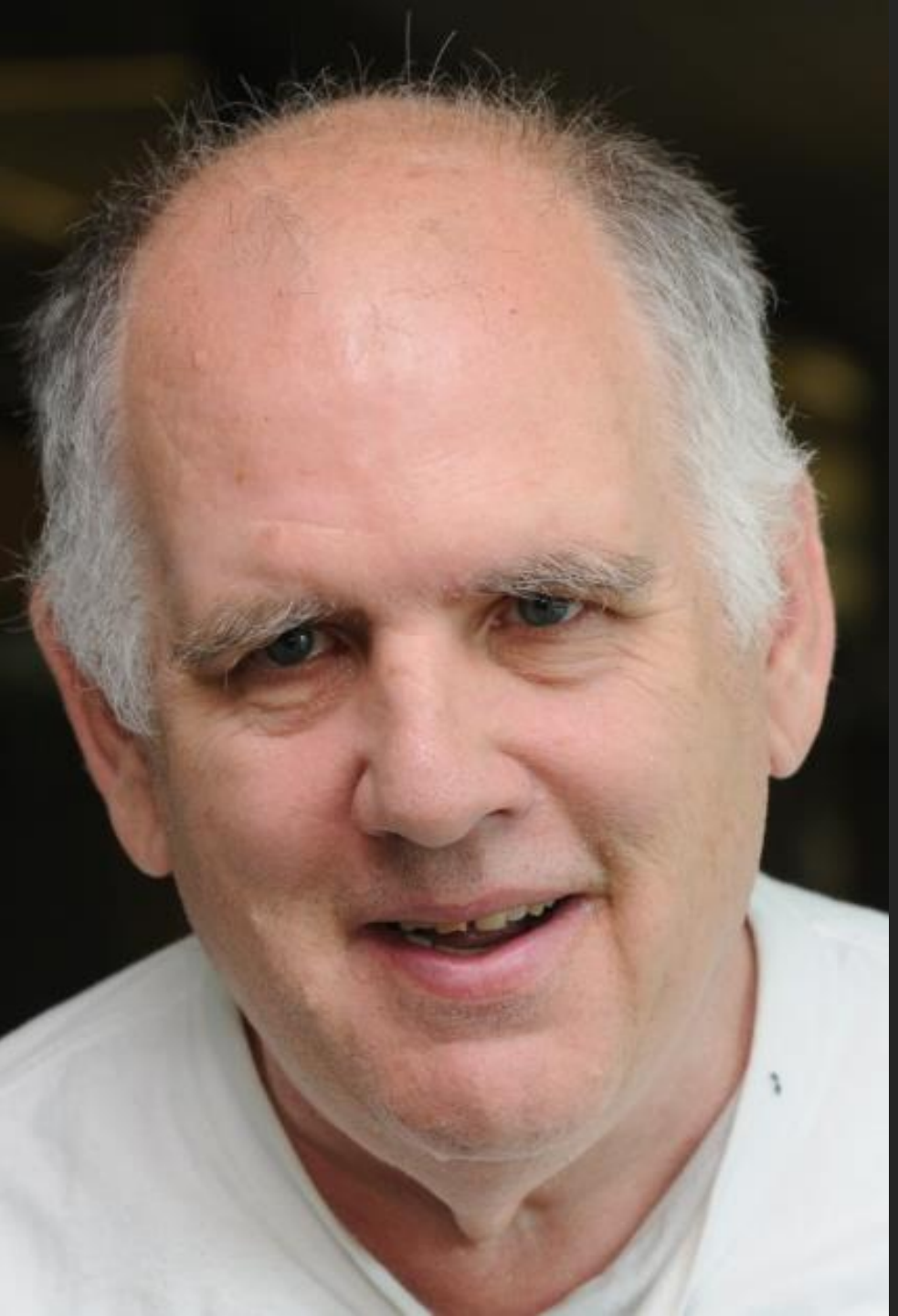


# Peter Lawrence Montgomery

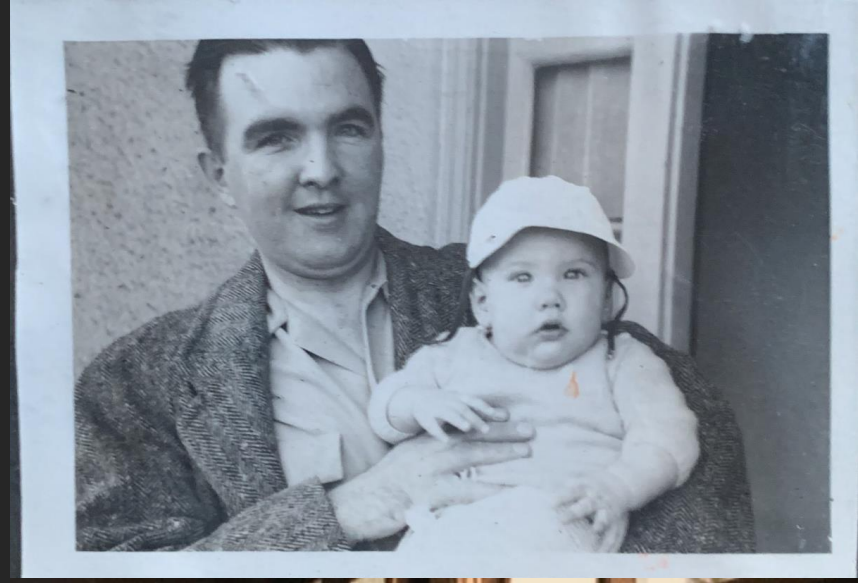
25 September 1947 – 18 February 2020

# Peter Lawrence Montgomery

Born on September 25, 1947 in San Francisco, CA

| | |
|---|---|
| 1967. | Among the five highest ranking participants in the William Lowell Putnam Mathematical competition |
| 1969. | BA in Mathematics (UC Berkeley) |
| 1971. | MA in Mathematics (UC Berkeley) |
| 1972-1982. | Scientific and system programming at System Development Corporation (SDC), Huntsville, Alabama |
| 1982-1989. | Transferred to SDC (later renamed Unisys) in Santa Monica, California |
| 1992. | PhD in mathematics under supervision of David G. Cantor<br>Thesis: An FFT extension of the elliptic curve method of factorization |
| 1998. | Joined Microsoft Research in Redmond, WA. |
| 2014. | Retirement. |

Died February 18, 2020 in Pong, Thailand



# Most widely used contributions

Have you
- visited a web page,
- performed an electronic payment,
- used a messaging application

today?

If so, then you have probably used one of the mathematical techniques proposed by and named after Peter Montgomery.

- Montgomery multiplication
  Main approach used in RSA
  → virtually all HTTPS certificates use RSA for signatures
- Montgomery curves
  Example: Curve25519 used in Signal, WhatsApp, TLS, etc
- Montgomery ladder
  Essential technique to harden (against side-channel attacks) ECC implementations. Used in billions of payments and transit products.

See for more info: www.joppebos.com/montgomery

2,1193-

# Integer Factorization Contributions

**General Purpose Factorization algorithms**

Run-time depends on the size of the input integer

- Multiple Polynomial Quadratic Sieve
- Number Field Sieve
  - Polynomial Selection
  - Line Sieving
  - Matrix step (block Lanczos)
  - Square root

**Special Purpose Factorization algorithms**

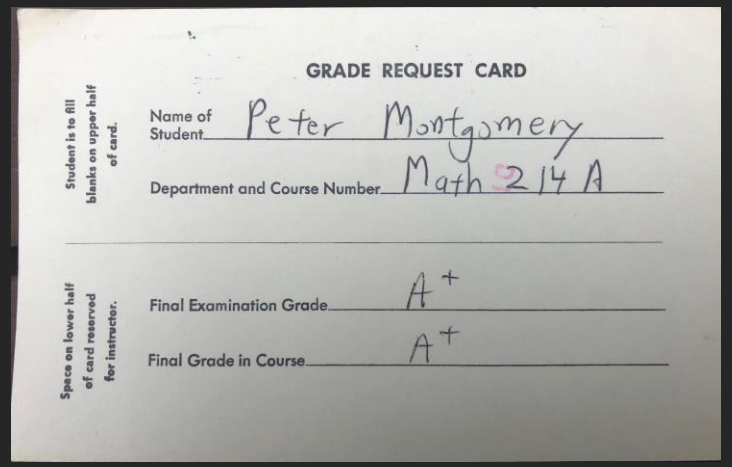
Run-time depends mainly on the size of the unknown prime divisor

- FFT approach for Stage 2 algorithms for Pollard p-1 and ECM (PhD topic)
- Speeding-up ECM
  - Montgomery curves
  - Montgomery ladder

**Selected Computational records**

2010. ECM factorization record
(73-digit factor of $2^{1181} - 1$)
2010. Integer factorization record: RSA-768
2009. 112-bit ECDLP record on cluster of PS3s
2000. Integer factorization record: RSA-512
1999. Integer factorization record: RSA-140

# “Other people have a work life and a personal life. I have a work life and a research life.”


GRADE REQUEST CARD

Student is to fill blanks on upper half of card.

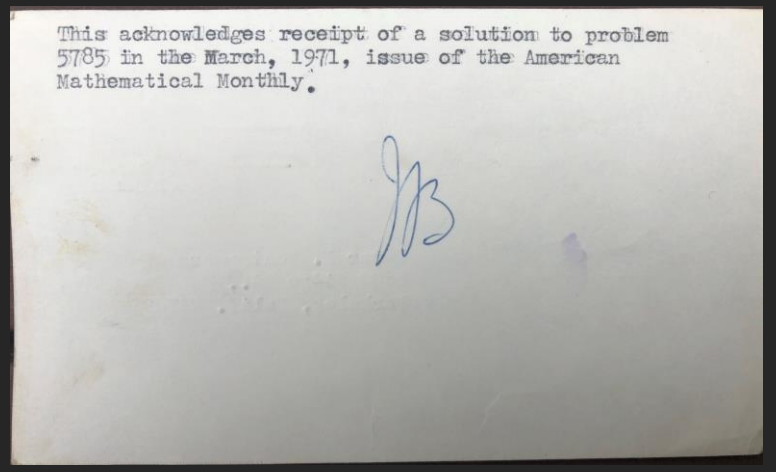
Name of Student Peter Montgomery

Department and Course Number Math 214 A

Space on lower half of card reserved for instructor.

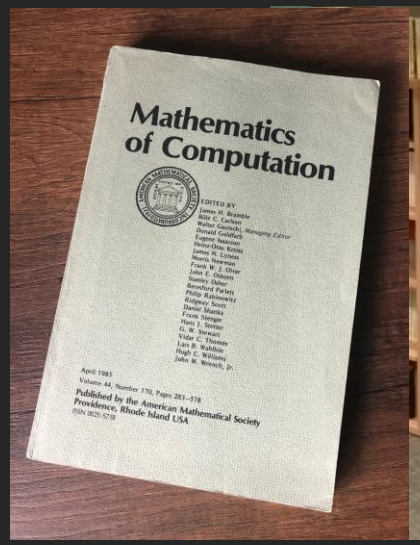
Final Examination Grade A+

Final Grade in Course A+


This acknowledges receipt of a solution to problem 5785 in the March, 1971, issue of the American Mathematical Monthly.

“Peter’s passion for his research, which aligned with his work life, was why his work was all consuming. He truly loved doing Mathematics.

It was in the mathematical community that Peter truly found his place, among people who shared his passions, and didn’t expect him to conform to arbitrary standards. This community was more than a career for him, it was where he belonged.” (Dan Shumow)




CITY OF SAN RAFAEL

PRESENTS THIS

RESOLUTION OF APPRECIATION

TO

PETER MONTGOMERY

**WHEREAS,** in January, 2001 the City Council directed a Shuttle Bus Feasibility Study; and

**WHEREAS,** staff was directed to form a Shuttle Study Advisory Group to help develop goals and objectives and to oversee the study process; and

**WHEREAS,** in April, 2001 Peter was invited by the Mayor to participate, as a key stakeholder, in the Shuttle Study Advisory Group; and

**WHEREAS,** Peter was a valuable participant and provided the committee with insight, experience and expertise, and helped to direct the study to benefit everyone in San Rafael; and

**WHEREAS,** the Shuttle Bus Feasibility Study will be used to implement future circulation and parking improvements in San Rafael.

**NOW, THEREFORE, BE IT RESOLVED** that the Mayor and City Council hereby express sincere appreciation and gratitude to Peter Montgomery for his substantial contribution of time and effort to complete the shuttle study that will serve to guide and assist with future public transportation projects, and for his commitment to the betterment of the San Rafael community.

MAYOR

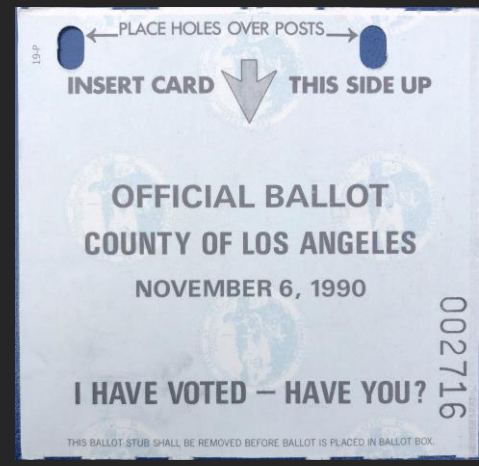
COUNCIL MEMBERS

CITY MANAGER

ATTESTED BY MY HAND THIS 18th DAY OF March, 2002

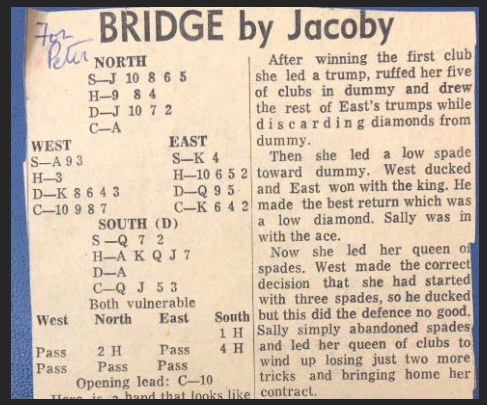
CITY CLERK

# WHERE'S MY LANE?




"The environmental movement blossomed while I was at Berkeley, and I vowed in 1972 never to drive again."

"But Huntsville lacked sidewalks between home and work. For one year, I walked with large placards "WE NEED SIDEWALKS" and "WHERE'S MY LANE", until the City Council voted to install sidewalks near schools and to fund bike lanes and paths."



BRIDGE by Jacoby

for Peter

NORTH
S—J 10 8 6 5
H—9 8 4
D—J 10 7 2
C—A

WEST
S—A 9 3
H—3
D—K 8 6 4 3
C—10 9 8 7

EAST
S—K 4
H—10 6 5 2
D—Q 9 5
C—K 6 4 2

SOUTH (D)
S —Q 7 2
H—A K Q J 7
D—A
C—Q J 5 3

Both vulnerable

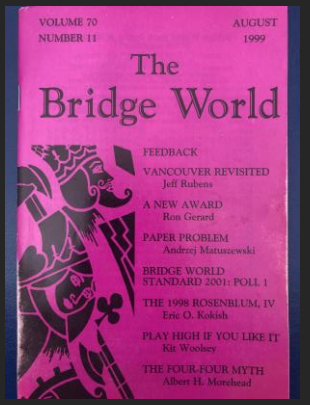
| West | North | East | South |
|---|---|---|---|
| | | | 1 H |
| Pass | 2 H | Pass | 4 H |
| Pass | Pass | Pass | |

Opening lead: C—10

After winning the first club she led a trump, ruffed her five of clubs in dummy and drew the rest of East's trumps while discarding diamonds from dummy.

Then she led a low spade toward dummy. West ducked and East won with the king. He made the best return which was a low diamond. Sally was in with the ace.

Now she led her queen of spades. West made the correct decision that she had started with three spades, so he ducked but this did the defence no good. Sally simply abandoned spades and led her queen of clubs to wind up losing just two more tricks and bringing home her contract.




"He was brilliant in pulling out some contracts with just stellar play of the hands - he always remembered every card played and would have made a fortune in Vegas as a card counter but had zero interest in that."
(Richard Montgomery, brother)

"It was difficult to play bridge with him because he would memorize each card as it was played and calculate who had what cards."
(Betty Montgomery, sister-in-law)

"He knew I liked bridge, so for many years he would cut out the bridge column from the newspaper on a daily or weekly basis and leave it on my desk in the morning so we could discuss it at lunch."
(Kristin Lauter)

# Peter Lawrence Montgomery

25 September 1947 – 18 February 2020

“Yet in spite of everything that limited him, Peter did what all of us hope to do, what all of us wish we could say at the end of our days. Peter made a difference.”
(Betty Montgomery, sister-in-law)