# FERMAT SIEVE USING COMPLEX NUMBERS

Fred Viole
OVVO Financial Systems
fred.viole@ovvofinancialsystems.com

FERMAT SIEVE USING COMPLEX NUMBERS

If $N = 4k - 1$ then $\{R\}$ is EVEN and $\{i\}$ is ODD

If the real part of the number $\{R\}$ is EVEN:

$p=(R - i)$ $q=(R + i)$

| And $\{R\}$ ends in: | | And $(i)$ ends in: | Resulting Reals (p,q) end in: | Example | Semi-Prime $\{N\}$ Ending In: 1 | 3 | 7 | 9 | Notes: |
|---|---|---|---|---|---|---|---|---|---|
| 2 | | 1 | (1,3) | (22-1)(22+1) | X | ⌂ | X | X | · No $\{R\}$ ending in 2 can generate $\{N\}$ ending in 1 or 7. |
| | | 3 | (9,5) | (22-3)(22+3) | X | X | X | X | · The highest probability is $\{N\}$ ending in 3. |
| | | 5 | (7,7) | (22-5)(22+5) | X | X | X | ⌂ | |
| | | 7 | (5,9) | (22-7)(22+7) | X | X | X | X | |
| | | 9 | (3,1) | (22-9)(22+9) | X | ⌂ | X | X | |
| 4 | | 1 | (3,5) | (24-1)(24+1) | X | X | X | X | · No $\{R\}$ ending in 4 can generate $\{N\}$ ending in 3 or 9. |
| | | 3 | (1,7) | (24-3)(24+3) | X | X | ⌂ | X | · The highest probability is $\{N\}$ ending in 7. |
| | | 5 | (9,9) | (24-5)(24+5) | ⌂ | X | X | X | |
| | | 7 | (7,1) | (24-7)(24+7) | X | X | ⌂ | X | |
| | | 9 | (5,3) | (24-9)(24+9) | X | X | X | X | |
| 6 | | 1 | (5,7) | (26-1)(26+1) | X | X | X | X | · No $\{R\}$ ending in 6 can generate $\{N\}$ ending in 3 or 9. |
| | | 3 | (3,9) | (26-3)(26+3) | X | X | ⌂ | X | · The highest probability is $\{N\}$ ending in 7. |
| | | 5 | (1,1) | (26-5)(26+5) | ⌂ | X | X | X | |
| | | 7 | (9,3) | (26-7)(24+7) | X | X | ⌂ | X | |
| | | 9 | (7,5) | (26-9)(26+9) | X | X | X | X | |
| 8 | | 1 | (7,9) | (28-1)(28+1) | X | ⌂ | X | X | · No $\{R\}$ ending in 8 can generate $\{N\}$ ending in 1 or 7. |
| | | 3 | (5,1) | (28-3)(28+3) | X | X | X | X | · The highest probability is $\{N\}$ ending in 3. |
| | | 5 | (3,3) | (28-5)(28+5) | X | X | X | ⌂ | |
| | | 7 | (1,5) | (28-7)(28+7) | X | X | X | X | |
| | | 9 | (9,7) | (28-9)(28+9) | X | ⌂ | X | X | |
| 0 | | 1 | (9,1) | (20-1)(20+1) | X | X | X | ⌂ | · No $\{R\}$ ending in 0 can generate $\{N\}$ ending in 3 or 7. |
| | | 3 | (7,3) | (20-3)(20+3) | ⌂ | X | X | X | · The highest probability is $\{N\}$ ending in 1 or 9. |
| | | 5 | (5,5) | (20-5)(20+5) | X | X | X | X | |
| | | 7 | (3,7) | (20-7)(20+7) | ⌂ | X | X | X | |
| | | 9 | (1,9) | (20-9)(20+9) | X | X | X | ⌂ | |

FERMAT SIEVE USING COMPLEX NUMBERS

If $N = 4k + 1$ then $\{R\}$ is ODD and $\{i\}$ is EVEN

If the real part of the number $\{R\}$ is ODD:

$p=(R - i)\ \ q=(R + i)$

| And $\{R\}$ ends in: | | And $(i)$ ends in: | Resulting Reals (p,q) end in: | Example | Semi-Prime $\{N\}$ Ending In: 1 | 3 | 7 | 9 | Notes: |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 2 | (9,3) | (21-2)(21+2) | X | X | ⌂ | X | · No $\{R\}$ ending in 1 can generate $\{N\}$ ending in 3 or 9.<br>· The highest probability is $\{N\}$ ending in 7. |
| | 4 | (7,5) | (21-4)(21+4) | X | X | X | X | |
| | 6 | (5,7) | (21-6)(21+6) | X | X | X | X | |
| | 8 | (3,9) | (21-8)(21+8) | X | X | ⌂ | X | |
| | 0 | (1,1) | (21-10)(21+10) | ⌂ | X | X | X | |
| 3 | 2 | (1,5) | (23-2)(23+2) | X | X | X | X | · No $\{R\}$ ending in 3 can generate $\{N\}$ ending in 1 or 7.<br>· The highest probability is $\{N\}$ ending in 3. |
| | 4 | (9,7) | (23-4)(23+4) | X | ⌂ | X | X | |
| | 6 | (7,9) | (23-6)(23+6) | X | ⌂ | X | X | |
| | 8 | (5,1) | (23-8)(23+8) | X | X | X | X | |
| | 0 | (3,3) | (23-10)(23+10) | X | X | X | ⌂ | |
| 5 | 2 | (3,7) | (25-2)(25+2) | ⌂ | X | X | X | · No $\{R\}$ ending in 5 can generate $\{N\}$ ending in 3 or 7.<br>· The highest probability is $\{N\}$ ending in 1 or 9. |
| | 4 | (1,9) | (25-4)(25+4) | X | X | X | ⌂ | |
| | 6 | (9,1) | (25-6)(25+6) | X | X | X | ⌂ | |
| | 8 | (7,3) | (25-8)(25+8) | ⌂ | X | X | X | |
| | 0 | (5,5) | (25-10)(25+10) | X | X | X | X | |
| 7 | 2 | (5,9) | (27-2)(27+2) | X | X | X | X | · No $\{R\}$ ending in 7 can generate $\{N\}$ ending in 1 or 7.<br>· The highest probability is $\{N\}$ ending in 3. |
| | 4 | (3,1) | (27-4)(27+4) | X | ⌂ | X | X | |
| | 6 | (1,3) | (27-6)(27+6) | X | ⌂ | X | X | |
| | 8 | (9,5) | (27-8)(27+8) | X | X | X | X | |
| | 0 | (7,7) | (27-10)(27+10) | X | X | X | ⌂ | |
| 9 | 2 | (7,1) | (29-2)(29+2) | X | X | ⌂ | X | · No $\{R\}$ ending in 9 can generate $\{N\}$ ending in 3 or 9.<br>· The highest probability is $\{N\}$ ending in 7. |
| | 4 | (5,3) | (29-4)(29+4) | X | X | X | X | |
| | 6 | (3,5) | (29-6)(29+6) | X | X | X | X | |
| | 8 | (1,7) | (29-8)(29+8) | X | X | ⌂ | X | |
| | 0 | (9,9) | (29-10)(29+10) | ⌂ | X | X | X | |