Math for Programming

Learn the Math, Write Better Code

by Ronald T. Kneusel

Errata updated to print 1

<table>
<tr><th>Page</th><th>Error</th><th>Correction</th><th>Print corrected</th></tr>
<tr><td>xi, 109, 111, 112, 114–115, 146–147, 467</td><td></td><td>All instances of "bubble sort" should read "exchange sort" and all instances of the <code>Bubble</code> function should refer to the <code>Exchange</code> function.</td><td>Pending</td></tr>
<tr><td>15</td><td>While the rational result matches the initial value, the floating-point result is already off in the 15th decimal, as the carat indicates.</td><td>While the rational result matches the initial value, the floating-point result is already off in the 15th decimal, as the caret indicates.</td><td>Pending</td></tr>
<tr><td>110</td><td>Before the loop begins, the invariants are true: $r^2 + \mathbf{2} = 0^2 + 25 = 25$ and $i = 2r + 1 = 2(0) + 1 = 1$.</td><td>Before the loop begins, the invariants are true: $r^2 + \boldsymbol{s} = 0^2 + 25 = 25$ and $i = 2r + 1 = 2(0) + 1 = 1$.</td><td>Pending</td></tr>
<tr><td>113</td><td><pre><code>int binary(int *A, int n, int v) {
    int mid, lo = 0, hi = n-1;
    while (lo <= hi) {
        mid = (lo + hi) / 2;</code></pre></td><td><pre><code>int binary(int *A, int n, int v) {
    int mid, lo = 0, hi = n-1;
    while (lo <= hi) {
        printf("%d %d %d\n",A[lo],v,A[hi]);
        mid = (lo + hi) / 2;</code></pre></td><td>Pending</td></tr>
<tr><td>156</td><td>$$p_n = \frac{p_{n-1} + p_n + 1}{2}$$</td><td>$$p_n = \frac{p_{n-1} + p_{n+1}}{2}$$</td><td>Pending</td></tr>
<tr><td>170</td><td><pre><code>def NaiveModularInverse(a, n):
    if (GCD(a, n) != 1):
        return None
    for i in range(0, n-1):</code></pre></td><td><pre><code>def NaiveModularInverse(a, n):
    if (GCD(a, n) != 1):
        return None
    for i in range(0, n):</code></pre></td><td>Pending</td></tr>
</table>

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191	We can now find the number of men without hats, courtesy of principle (d): $\lvert M - H \rvert = \lvert M \rvert + \lvert M \cap H \rvert = 60 - 42 = 22$	We can now find the number of men without hats, courtesy of principle (d): $\lvert M - H \rvert = \lvert M \rvert - \lvert M \cap H \rvert = 60 - 42 = 18$	Pending
191	Principle (f) gives us a clue by informing us of the following: $\lvert M \triangle H \rvert = \lvert M - H \rvert + \lvert H - M \rvert = 22 + 32 = 54$ The symmetric difference is the set of men without hats (*M-H*) and women with hats (*H-M*). Therefore, we know that **54** people are either a man without a hat or a woman with a hat. Finally, how many ways are there to pair men without hats and women with hats? We're asking for the cardinality of the Cartesian product between $M - H$ and $H - M$. Here's where we use principle (e) $\lvert (M - H) \times (H - M) \rvert = \lvert M - H \rvert \lvert H - M \rvert = (22)(32) = 704$ to learn that there are **704** ways to pair a man without a hat and a woman with a hat.	Principle (f) gives us a clue by informing us of the following: $\lvert M \triangle H \rvert = \lvert M - H \rvert + \lvert H - M \rvert = 18 + 28 = 46$ The symmetric difference is the set of men without hats (*M-H*) and women with hats (*H-M*). Therefore, we know that **46** people are either a man without a hat or a woman with a hat. Finally, how many ways are there to pair men without hats and women with hats? We're asking for the cardinality of the Cartesian product between $M - H$ and $H - M$. Here's where we use principle (e) $\lvert (M - H) \times (H - M) \rvert = \lvert M - H \rvert \lvert H - M \rvert = (18)(28) = 504$ to learn that there are **504** ways to pair a man without a hat and a woman with a hat.	Pending