ALGORITHMIC

hello, world

1. Basic forms

1.1. The Simple Statement.

$S \leftarrow O$

1.2. Simple Statement with Comment.

$S \leftarrow O$ {comment}

1.3. The Precondition (never numbered).

Require: $x \neq 0$ and $n \geq 0$ {blah blah blah}

1.4. The Postcondition (never numbered).

Ensure: $x \neq 0$ and $n \geq 0$ {blah blah blah}

1.5. Globals.

globals x, y {blah blah blah}

1.6. Inputs.

inputs {comment}
    x, y

1.7. Outputs.

outputs {comment}
    x, y

1.8. The body.

do {comment}
    something 1
    something 2

1.9. The *if-then-else* Statement.

if some condition is true **then** {comment}
    do some processing
else if some other condition is true **then** {comment}
    do some different processing
else if some even more bizarre condition is met **then** {comment}
    do something else
else {comment}
    do the default actions
end if

1.10. The *for* Loop.

for $i = 0$ to 10 **do** {comment}
  carry out some processing
end for

for all i such that $0 \leq i \leq 10$ **do** {comment}
  carry out some processing
end for

for $i = 0$ **to** 10 **do** {comment}
  carry out some processing
end for

1.11. The *while* Loop.

while some condition holds **do** {comment}
  carry out some processing
end while

1.12. The *repeat-until* Loop.

repeat {comment}
  carry out some processing
until some condition is met

1.13. The Infinite Loop.

loop {comment}
  this processing will be repeated forever
end loop

1.14. Returning Values.

return $(x + y)/2$

1.15. Printing Messages.

print `''Hello, World!''`

2. Some longer examples

2.1. *if-elsif-else*.

$a \leftarrow 1$
if a is even **then**
  print "a is even"
else if a is odd **then**
  print "a is odd"
else
  print "a is really weird"
end if

2.2. Nested structures.

Require: $n \geq 0$
Ensure: $y = x^n$
$y \leftarrow 1$
$X \leftarrow x$
$N \leftarrow n$

while $N \neq 0$ **do**
  if N is even **then**
    $X \leftarrow X \times X$
    $N \leftarrow N/2$
  else $\{N$ is odd$\}$
    $y \leftarrow y \times X$
    $N \leftarrow N - 1$
  end if
end while

2.3. mcom3655.

Input: Choose an arbitrary $\alpha_L^0 \in \mathbb{C}^{(L+1)^2}$, $\{\epsilon^k\}$ with $\epsilon^k > 0$. Set $k = 0$.
while a termination criterion is not met, **do**
  1) Solve the weighted ℓ_2 minimization problem

$$\alpha_{l\cdot}^{k+1} = \arg \min_{\alpha_{l\cdot} \in \mathbb{C}^{2l+1}} \left\{ \frac{1}{2} \|\alpha_{l\cdot} - \alpha_{l\cdot}^{\circ}\|_2^2 + \frac{1}{2} \lambda p \beta_l w_l^k \|\alpha_{l\cdot}\|_2^2 \right\}, l = 0, 1, \ldots, L, \tag{1}$$

  where $w_l^k = (\|\alpha_{l\cdot}^k\|_2^2 + \epsilon^k)^{\frac{p}{2}-1}$.
  2) Set $k \leftarrow k + 1$ and go to step 1).
end while

2.4. mcom3356.

Require: A lower trapezoidal $n \times (n-1)$ matrix $\mathbf{H} = (h_{i,j})$ with $h_{i,j} = 0$ if $j > i$ and $h_{j,j} \neq 0$.
Ensure: A unimodular matrix $\mathbf{D}$ such that $\mathbf{H} := \mathbf{D} \cdot \mathbf{H} = (h_{i,j})$ satisfying $|h_{i,j}| \leq |h_{j,j}|/2$ for $1 \leq j < i \leq n$.

$\mathbf{D} := \mathbf{I}_n$.
for i from 2 to n **do**
  for j from $i - 1$ to 1 by stepsize -1 **do**
    $q := \lfloor h_{i,j}/h_{j,j} + 0.5 \rfloor$.
    for k from 1 to n **do**
      $d_{i,k} := d_{i,k} - q d_{j,k}$.
    end for
  end for
end for

2.5. mcom3363.

Require: A polynomial h with irreducible factors of degree d over $k = \mathbb{F}_q[X]/f(X)$.
Ensure: An irreducible factor of h over k.

If $\deg h = d$ return h.
Take a random polynomial $a_0 \in k[Z]$ of degree less than $\deg h$,
Compute $a_1 \leftarrow \sum_{i=0}^{md-1} a_0^{q^i} \mod h$,
if q is an even power $q = 2^e$ **then**
  Compute $a_2 \leftarrow \sum_{i=0}^{e-1} a_1^{2^i} \mod h$
else
  Compute $a_2 \leftarrow a_1^{(q-1)/2} \mod h$
end if
Compute $h_0 \leftarrow \gcd(a_2, h)$ and $h_1 \leftarrow \gcd(a_2 - 1, h)$ and $h_{-1} \leftarrow h/(h_0 h_1)$,
Apply recursively to the smallest non-constant polynomial among h_0, h_1, h_{-1}.

2.6. **mcom3385 (with endtags=no).**

Require: A rational number $\alpha = a/b$.
Ensure: The algorithm tells whether the RCF expansion of α is finite or periodic.

$x := \alpha$
$B_1 := \max\left(\frac{\log b}{\log \ell}, 2\right)$
for $i = 1$ to B_1 **do**
  if $x < 0$ **then**
    return The expansion is periodic.
  $y := x - \lfloor x \rceil_\ell$
  if $y == 0$ **then**
    return The expansion is finite.
  $x := 1/y$