```
Data: Set the control parameters of the ABC algorithm
$SN$: Number of Foods
$limit$: Maximum number of trial for abandoning a source
$MFE$: Maximum number of fitness evaluations
begin
    //Initialization;
    $num\_eval \longleftarrow 0$ ;
    for $s = 1$ to $SN$ do
        $X(s) \longleftarrow$ random solution by Eq. 1 [3];
        $f_s \longleftarrow f(X(s))$;
        $trial(s) \longleftarrow 0$;
        $num\_eval + +$ ;
    end
    repeat
        //Employed Bees Phase;
        for $s = 1$ to $SN$ do
            $x' \longleftarrow$ a new solution produced by Eq. 2 [3];
            $f(x') \longleftarrow$ evaluate new solution;
            $num\_eval + +$;
            if $f(x') < f_s$ then
                $X(s) \longleftarrow x'$; $f_s \longleftarrow f(x')$; $trial(s) \longleftarrow 0$;
            else
                $trial(s) \leftarrow trial(s) + 1$;
            end
            if $num\_eval == MFE$ then
                Memorize the best solution achieved so far and exit main repeat;
            end
        end
        Calculate the probability values $p_i$ for the solutions using fitness values by Eqs. 3 and 4 [3];
        //Onlooker bee phase;
        $s \longleftarrow 1$; $t \longleftarrow 1$ ;
        repeat
            $r \longleftarrow rand(0, 1)$;
            if $r < p(s)$ then
                $t \longleftarrow t + 1$;
                $x' \longleftarrow$ a new solution produced by Eq. 2 [3];
                $f(x') \longleftarrow$ evaluate new solution;
                $num\_eval + +$;
                if $f(x') < f_s$ then
                    $X(s) \longleftarrow x'$; $f_s \longleftarrow f(x')$; $trial(s) \longleftarrow 0$;
                else
                    $trial(s) \longleftarrow trial(s) + 1$;
                end
                if $num\_eval == MFE$ then
                    Memorize the best solution achieved so far and exit main repeat;
                end
            end
            $s \longleftarrow (s \ mod \ SN) + 1$;
        until $t = SN$ ;
        //Scout Bee Phase;
        $mi \longleftarrow \{s : trial(s) = max(trial)\}$;
        if $trial(mi) >= limit$ then
            $X(mi) \longleftarrow$ random solution by Eq. 1 [3];
            $f_{mi} \longleftarrow f(X(mi))$;
            $num\_eval + +$ ;
            $trial(mi) \longleftarrow 0$;
            if $num\_eval == MFE$ then
                Memorize the best solution achieved so far and exit main repeat;
            end
        end
        Memorize the best solution achieved so far;
    until $num\_eval = MFE$ ;
end
```

Algorithm 1: The pseudo-code of $ABC_{imp1}(FEs)$

```
Data: Set the control parameters of the ABC algorithm
$SN$: Number of Foods
$limit$: Maximum number of trial for abandoning a source
$MCN$: Maximum number of cycles
begin
    //Initialization;
    $num\_eval \longleftarrow 0$ ;
    for $s = 1$ to $SN$ do
        $X(s) \longleftarrow$ random solution by Eq. 1 [3];
        $f_s \longleftarrow f(X(s))$;
        $trial(s) \longleftarrow 0$;
        $num\_eval++$;
    end
    $cycle \longleftarrow 1$;
    while $cycle < MCN$ do
        //Employed Bees Phase;
        $mi \longleftarrow \{s : trial(s) = max(trial)\}$;
        for $s = 1$ to $SN$ do
            if $(trial(s) < limit$ or $s != mi)$ then
                $x' \longleftarrow$ a new solution produced by Eq. 2 [3];
                $f(x') \longleftarrow$ evaluate new solution;
                $num\_eval++$ ;
                if $f(x') < f_s$ then
                    $X(s) \longleftarrow x'$; $f_s \longleftarrow f(x')$; $trial(s) \longleftarrow 0$;
                else
                    $trial(s) \longleftarrow trial(s) + 1$;
                end
            end
        end
        Memorize the best solution achieved so far;
        //Scout Bee Phase;
        if $(trial(mi) >= limit$ then
            $X(mi) \longleftarrow$ random solution by Eq. 1 [3];
            $f_{mi} \longleftarrow f(X(mi))$;
            $num\_eval++$ ;
            $trial(mi) \longleftarrow 0$;
        end
        Calculate the probability values $p_i$ for the solutions using fitness values by Eqs. 3 and 4 [3];
        //Onlooker Bees Phase;
        $s \longleftarrow 1$; $t \longleftarrow 1$ ;
        while $t \leq SN$ do
            $r \longleftarrow rand(0, 1)$;
            if $r < p(s)$ then
                $t \longleftarrow t + 1$;
                $x' \longleftarrow$ a new solution produced by Eq. 2 [3];
                $f(x') \longleftarrow$ evaluate new solution;
                $num\_eval++$ ;
                if $f(x') < f_s$ then
                    $X(s) \longleftarrow x'$; $f_s \longleftarrow f(x')$; $trial(s) \longleftarrow 0$;
                else
                    $trial(s) \longleftarrow trial(s) + 1$;
                end
            end
            $s \longleftarrow (s \mod SN) + 1$;
        end
        Memorize the best solution achieved so far;
        $cycle++$;
    end
end
```

Algorithm 2: The pseudo-code of the $ABC_{imp2}(FEs)$