Input:

A finite set $F := \{f_1, \ldots, f_k\}$ of polynomials in $K[X_1, \ldots, X_n]$ with head coefficients 1 and an admissible order $\succ$ on M_n.

Output:

A finite set G_i of polynomials in $K[X_1, \ldots, X_n]$ that is a Gröbner basis of $J := \langle f_1, \ldots, f_k \rangle$.

Initialization:

$i := 0;\ \ G_0 := F;$
$B_0 := \{(f_i, f_j) \mid 1 \le i < j \le k\};$

`while` $B_i \neq \emptyset$ `do`

(a) Choose a pair $(f_l, f_r) \in B_i$;
(b) Compute the S-polynomial $S(f_l, f_r)$;
(c) Compute a $\rightarrow_{G_i}$-normal form h of $S(f_l, f_r)$;
(d) If $h \neq 0$, then
$B_{i+1} := (B_i - \{(f_l, f_r)\}) \cup \{(f, HC(h)^{-1} \cdot h) \mid f \in G_i\};$
$G_{i+1} := G_i \cup \{HC(h)^{-1} \cdot h\};$
$i := i + 1;$
(e) Otherwise, $B_{i+1} := B_i - \{(f_l, f_r)\};\ G_{i+1} := G_i;\ i := i + 1;$

`od`

Output G_i;

Fig. 8.1. Buchberger's algorithm.