Algorithm 1: assign labels

Input: *focus and previous rows of* A, *previous row of* Q, *label directory* D
Output: *current row of* Q

```
1  for column = 1 to M do
2      if class ≠ noData then
3          if class ≠ classUp and class ≠ classLeft then
4              assign New Label;
5              add New Label To Directory;
6          else
7              if class ≠ classUp and class = classLeft then
8                  assign Left Label;
9              else
10                 if class = classUp and class ≠ classLeft then
11                     assign UpLabel;
12                 else
13                     if LeftLabel = UpLabel then
14                         assign UpLabel;
15                     else
16                         assign UpLabel;
17                         if pass = 1 then
18                             update Dictionary;
```

Algorithm 2: Basic structure of r.clump

Input: Multi-categorical raster A
Output: Connected components labels raster Q

```
for row = 1 to N do
    read focus and previous rows;
    execute algorithm assign labels to assign
    temporary labels to cells in the focus row;
    update dictionary D with temporary labels;
re-order labels in dictionary to obtain consecutive numbering; for
row = 1 to N do
    read focus and previous rows;
    execute algorithm assign labels to assign final
    labels to cells in the focus row;
    update dictionary D with final labels;
    write a focus row of labels to output Q;
```