Given a graph, a *vertex coloring* assigns a label, traditionally called 'color', to each vertex of the graph such that no two adjacent vertex have the same color. In this assignment, vertex coloring has been performed using the *backtracking* approach.

Algorithm `vertex_coloring_using_backtracking`

This algorithm tries to perform m-coloring of the given graph by using the backtracking approach.

Input: A graph $G(V, E)$ (where $V = \{v_1, v_2, \cdots, v_n\}$ with $n = |V|$, the number of vertices in the graph G and $E = \{(i, j) : \exists$ an edge between v_i and $v_j\}$), the set of colors $C = \{c_1, c_2, c_3, \ldots, c_m\}$ with the total number of available colors $m = |C|$, the current vertex to be colored v_i (starting with v_1) and current vertex coloring as a mapping $f : V \to C$.

Output: Returns **`true`** when the graph is m-colorable, with the complete coloring in f. Otherwise, returns **`false`**.

Steps:

Step 1: (If coloring is complete) If i is greater than n then
Step 2:   Return **`true`**.
    [End If.]
Step 3: $k \leftarrow 1$.
Step 4: Repeat step 5 to 18 while $k \le m$.
Step 5:   `valid` $\leftarrow$ **`true`**, $j \leftarrow 1$.
Step 6:   Repeat step 7 to 10 while $j \le n$.
        (If vertices v_i and v_j are adjacent, v_j has been assigned a color, $f(v_j)$ and $c_k = f(v_j)$, then the color c_k can not be used for vertex v_i, so next color is tried.)
Step 7:   If $(i, j) \in E$, $f(v_j)$ exists and $c_k = f(v_j)$ then
Step 8:   `valid` $\leftarrow$ **`false`**.
Step 9:   Break.
        [End If.]
Step 10: $j \leftarrow j + 1$.
    [End of Repeat.]
Step 11:   If `valid` is **`false`** then
Step 12:   Continue at step 18 in the way towards next iteration.
    [End If.]
    (Assign $f(v_i)$ to c_k.)
Step 13: $f \leftarrow f \cup \{(v_i, c_k)\}$
Step 14:   Recursively invoke `vertex_coloring_using_backtracking` with the vertex v_{i+1} to be colored, returning in `success`.
Step 15:   If `success` is **`true`** then
Step 16:   Return **`true`**.
    [End If.]
    (Discard and retract the mapping of $f(v_i)$.)
Step 17: $f \leftarrow f \setminus \{(v_i, c_k)\}$
Step 18: $k \leftarrow k + 1$.
[End of Repeat.]
Step 19: Return **`false`**.