

Algorithm 1: A pseudocode of the execution process of the virtual environment.

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Input: The size of the grid  $s$ ,
The size of population  $N$ ,
Number of infectious population  $M$ ,
Number of days staying exposed  $E_t$ ,
Number of days staying infectious  $I_t$ ,
Number of daily movements  $M_t$ ,
Number of days  $D$ 

1  $S \leftarrow \{(x, y, d) \in \mathbb{N} | 0 \leq x, y \leq s \text{ and } d = 0\}$  and  $|S| = N - M$ ; /* susceptible population */
2  $E \leftarrow \{\}$ ; /* exposed population */
3  $I \leftarrow \{(x, y, d) \in \mathbb{N} | 0 \leq x, y \leq s \text{ and } d = 0\}$  and  $|I| = M$ ; /* infectious population */
4  $R \leftarrow \{\}$ ; /* recovered population */
5  $P \leftarrow S \cup E \cup I \cup R$ ; /* total population */
6  $Economy \leftarrow 0$ ; /* total economic transaction */

/* loop for each day */
7 for  $day \leftarrow 1$  to  $D$  do
    /* loop for each step */
    8 for  $m_t \leftarrow 1$  to  $M_t$  do
        /* loop for each person */
        9 for  $p \in P$  do
            /*  $\mathbb{Z} \cap [-1, 1]$  defines picking a random integer from -1, 0, and 1 */
            10  $x_t \leftarrow \max(\min(p(x) + \mathbb{Z} \cap [-1, 1], s), 0)$ ; /* making valid movements in the grid */
            11  $y_t \leftarrow \max(\min(p(y) + \mathbb{Z} \cap [-1, 1], s), 0)$ ;
            12  $z_t \leftarrow p(z) + 1$ ; /* updating the day counter */
            /* if the person is in recovered state */
            13 if  $p \in R$  then
                14  $P \leftarrow (P - p) \cup \{(x_t, y_t, 0)\}$ ; /* no state upates for recovered population */
            /* if the person is in infectious state */
            15 else if  $p \in I$  then
                /*  $\mathbb{N} \cap [0, 6]$  defines picking a random integer in range [0, 6] */
                16 if  $z_n - \mathbb{N} \cap [0, 6] \geq I_t$  then
                    /* randomly choose if a person survives, and the probability distribution of choosing 1
                    over 0 is 1:4 */
                    17 if  $\mathbb{N} \cap [0, 1] = 1$  then
                        18  $P \leftarrow P - p$ ; /* dead person are removed from the states */
                    else
                        19  $R \leftarrow R \cup \{(x_t, y_t, 0)\}$ ; /* recovered person is moved to recovered state */
                        20  $P \leftarrow (P - p) \cup \{(x_t, y_t, 0)\}$ ;
                        21  $I \leftarrow I - p$ ;
                else
                    22  $P \leftarrow (P - p) \cup \{(x_t, y_t, z_t)\}$ ;
                    23  $I \leftarrow (I - p) \cup \{(x_t, y_t, z_t)\}$ ;
            /* if the person is in exposed state */
            24 else if  $p \in E$  then
                /*  $\mathbb{N} \cap [0, 1]$  defines picking a random integer 0 or 1 */
                25 if  $z_n - \mathbb{N} \cap [0, 1] \geq E_t$  then
                    26  $E \leftarrow E - p$ ;
                    27  $I \leftarrow I \cup \{(x_t, y_t, 0)\}$ ;
                    28  $P \leftarrow (P - p) \cup \{(x_t, y_t, 0)\}$ ;
                else
                    29  $E \leftarrow (E - p) \cup \{(x_t, y_t, z_t)\}$ ;
                    30  $P \leftarrow (P - p) \cup \{(x_t, y_t, z_t)\}$ ;
            /* if the person is in susceptible state */
            31 else
                /* check if the person is in close contact with any of the infectious person */
                32 if  $(x_n + [-1, 1], y_n + [-1, 1], \mathbb{N}) \in I$  then
                    33  $I \leftarrow I \cup \{(x_t, y_t, 0)\}$ ; /* move the person in exposed state */
                    34  $P \leftarrow (P - p) \cup \{(x_t, y_t, 0)\}$ ;
                else
                    35  $P \leftarrow (P - p) \cup \{(x_t, y_t, z_t)\}$ ;
            /* except of the person is not infectious (and not dead) he/she contributes to the economy */
            36 if  $p \notin I$  then
                37  $Economy \leftarrow Economy + \mathbb{R} \cap [0.8, 1]$ ;
            38
            39
            40
            41

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