1 Exercise 1

1. d

This is the adjacency matrix of graph G that I use.

$$\begin{pmatrix} 0 & 3 & 5 & +\infty & 6 \\ +\infty & 0 & 4 & -1 & 4 \\ +\infty & +\infty & 0 & +\infty & 2 \\ +\infty & +\infty & 4 & 0 & 12 \\ 5 & +\infty & +\infty & -5 & 0 \end{pmatrix}$$

After iteration one, k=1:

$$\begin{pmatrix} 0 & 3 & 5 & +\infty & 6 \\ +\infty & 0 & 4 & -1 & 4 \\ +\infty & +\infty & 0 & +\infty & 2 \\ +\infty & +\infty & 4 & 0 & 12 \\ 5 & \mathbf{8} & \mathbf{10} & -5 & 0 \end{pmatrix} \quad \begin{pmatrix} nil & 1 & 1 & nil & 1 \\ nil & nil & 2 & 2 & 2 \\ nil & nil & nil & nil & 3 \\ nil & nil & 4 & nil & 4 \\ 5 & \mathbf{1} & \mathbf{1} & 5 & nil \end{pmatrix}$$

After iteration one, k=2:

$$\begin{pmatrix} 0 & 3 & 5 & \mathbf{2} & 6 \\ +\infty & 0 & 4 & -1 & 4 \\ +\infty & +\infty & 0 & +\infty & 2 \\ +\infty & +\infty & 4 & 0 & 12 \\ 5 & 8 & 10 & -5 & 0 \end{pmatrix} \quad \begin{pmatrix} nil & 1 & 1 & \mathbf{2} & 1 \\ nil & nil & 2 & 2 & 2 \\ nil & nil & nil & nil & 3 \\ nil & nil & 4 & nil & 4 \\ 5 & 1 & 1 & 5 & nil \end{pmatrix}$$

2.1 b **2.2** c
3 f
4 a, a, b
5 4
6 c
7 d

2 Exercise 2

1 Constant time and linear time O(n).
2 Consider the set X contains all edges. Each vertex corresponds to a subset of X that contains the edges that are incident to the vertex.

If the maximum degree of an vertex in the given graph is smaller than or equal to 3. ALG2 gives a better approximation ratio. In particular, if the maximum degree is 1, then H(1)=1, ALG2 is exact algorithm; if the maximum degree is 2, then H(2)=1+(1/2)=1.5, ALG2 is 1.5-approximation algorithm; if the maximum degree

is 3, then H(3)=1+(1/2)+(1/3)=11/6, ALG2 is 11/6-approximation algorithm. If the maximum degree is greater than 3, then ALG1, which is 2-approximation algorithm, is better.

3 Total number of vertices: N+M+2.

Three sets of vertices:

1. A source and a destination.
2. M vertices correspond to workers.
3. N vertices correspond to tasks.

Three sets of edges:

1. from the source to each worker, in total M such edges. The capacity of each such edge is the corresponding worker's maxTaskNUm.
2. from a worker to a task: such an edge exists if the task is within the worker's active circle. The capacity is of each such edge is 1. The total number depends on how the tasks and works are distributed.
3. from a task to the destination: in total N such edges. the capacity of each such edge is 1.

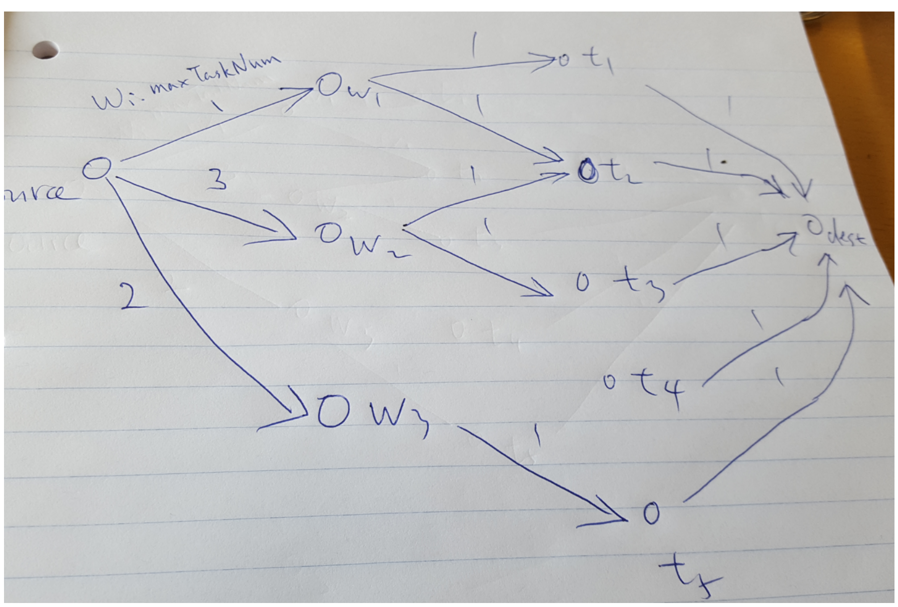

Figure 1: Spatial crowd sourcing