

# BLG337E: Principles of Computer Communications

## Homework #3

Due Date: 20.12.2016, 23:00

Write a program to simulate wireless stations that transmit data on a wireless medium.

A “**stations.txt**” file contains the list of stations. Stations are located on a **NxN** grid. Each line of the file contains station’s name as a single character, row and column numbers of the station within the grid, and transmission range of the station. Figure 1 shows an example **stations.txt** file and 3 given stations on a 10x10 (i.e., **N=10**) grid.

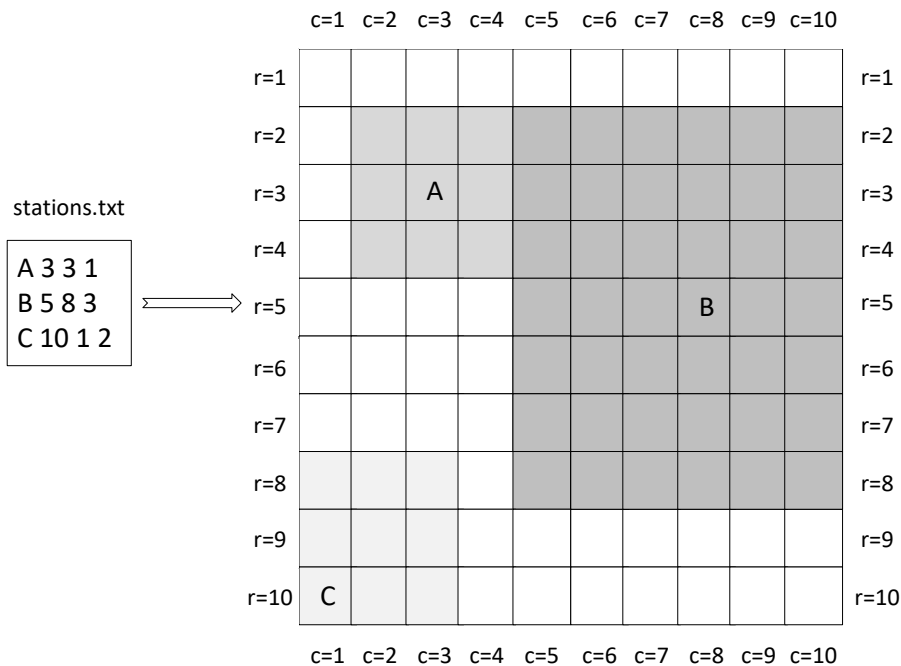


Figure 1 Stations and their ranges specified by **stations.txt** file

“**transmissions.txt**” file contains data transmission events. Each line of the file contains transmitter station’s name, receiver station’s name, and start time of transmission. Figure 2 shows an example **transmissions.txt** file and propagation of signals as well as the virtual time clock. The virtual clock starts from 0 and increases by 1 after all the events (if any) are processed which are scheduled for that time.

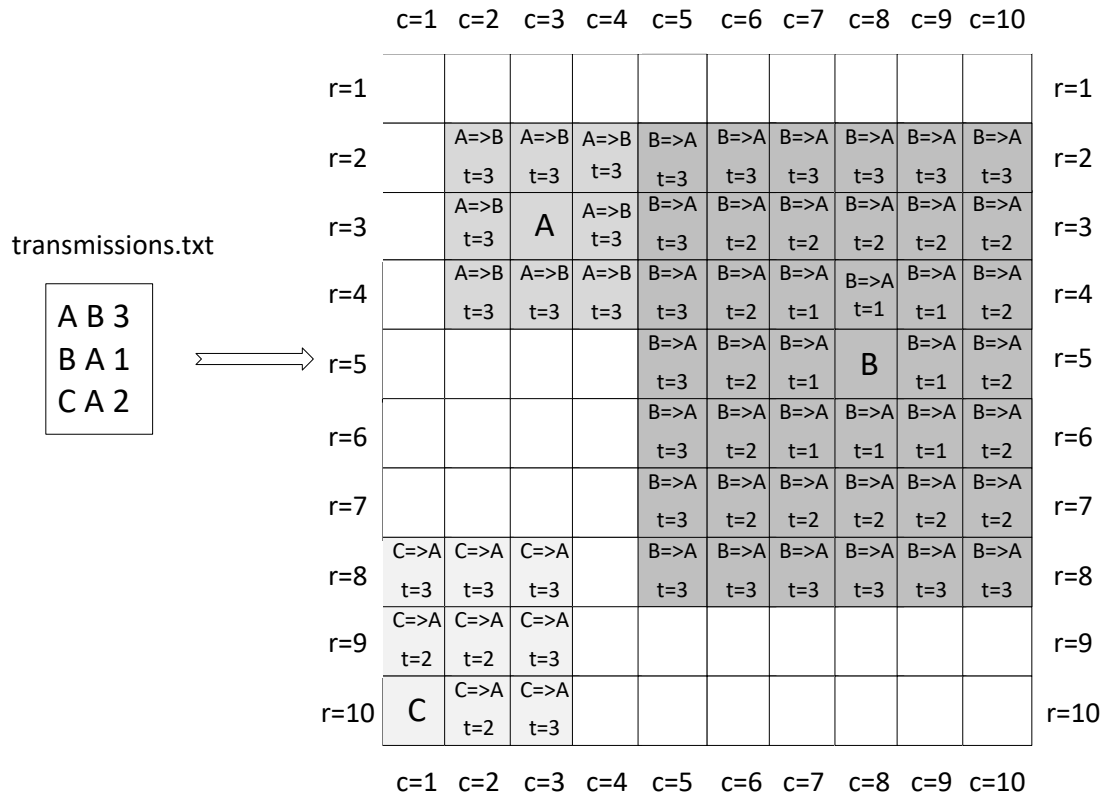


Figure 2: Transmission events specified in “transmissions.txt” file and propagation of signals

Please note:

- Transmission range of 1 unit includes all the cells surrounding the station (e.g., see station A).
- Transmission range of 2 units includes all the cells surrounding the station as well as all the cells surrounding the cells surrounding the station...etc.
- If the transmission range contains cells that are out of the grid, then they are discarded (e.g., station C has a range of 2 but its signal only propagates within its transmission range in the grid).
- Signal propagates with a speed of 1 unit/time in all directions.
- For simplicity, the example scenario shows no overlapping of either ranges or transmission events. In addition, no station is within the range of other stations. In the homework scenarios, **all these cases can happen!** Thus, you have to test your code for different scenarios representing different cases.

A transmission attempt can fail if:

- the receiver station is out of transmission range of the transmitting station. That is, signals can't reach to the receiver.
- signals from two (or more) transmitting stations reach to same receiver station at the same time (i.e., a collision).

Your program must decide whether the transmission events specified in **transmissions.txt** are successful or not. The results must be written into “**student\_id.txt**” file where **student\_id** is your student number:

- On successful transmissions add a line as follows:

SUCCESS:TSN=>RSN (Start time of transmission => time of arrival)

Where **TSN** is transmitter station’s name and **RSN** is receiver station’s name. **Time of arrival** is the time when signal reaches to the receiver.

- On out-of-range failures add a line as follows:

OOR:TSN=>RSN (Start time of transmission => Time of failure)

Where **TSN** is transmitter station’s name and **RSN** is receiver station’s name. **Time of failure** is the time when signal reaches to sender’s transmission range.

- On collision failures (**for each transmitter station that causes collision**), add a line as follows:

COLLISION:TSN=>RSN (Start time of transmission => Time of failure)

Where **TSN** is transmitter station’s name and **RSN** is receiver station’s name. **Time of failure** is the time when two (or more) signals reach to the receiver at the same time (i.e., when collision occurs).

Your program will be executed as follows:

**program.exe N**

where **N** is the dimension of the grid.

**You have to submit:**

1. The **source file** which is written in **c** programming language and named as “**student\_id.c**”. The source file **MUST BE** compilable and runnable in **Linux**. Please write your development environment at the start of the source file as well as your name, surname and student ID, of course within comments!
2. A **PDF report** which is named as “**student\_id.pdf**”.

## AN EXAMPLE RUN (N = 10)

stations.txt

```
A 3 3 3
B 5 5 3
C 7 7 2
D 2 5 1
```

transmissions.txt

```
A B 1
D C 5
C B 1
B C 3
```

	c=1	c=2	c=3	c=4	c=5	c=6	c=7	c=8	c=9	c=10	
r=1											r=1
r=2		A->B	A->B	A->B	D						r=2
r=3		A->B	A	A->B							r=3
r=4		A->B	A->B	A->B							r=4
r=5					B						r=5
r=6						C->B	C->B	C->B			r=6
r=7						C->B	C	C->B			r=7
r=8						C->B	C->B	C->B			r=8
r=9											r=9
r=10											r=10

150188888.txt

Time = 1  
- Transfer from A to B started  
- Transfer from C to B started

stations.txt

```
A 3 3 3
B 5 5 3
C 7 7 2
D 2 5 1
```

transmissions.txt

```
A B 1
D C 5
C B 1
B C 3
```

	c=1	c=2	c=3	c=4	c=5	c=6	c=7	c=8	c=9	c=10	
r=1	A->B	A->B	A->B	A->B	A->B						r=1
r=2	A->B				D						r=2
r=3	A->B		A		A->B						r=3
r=4	A->B				A->B						r=4
r=5	A->B	A->B	A->B	A->B	B	C->B	C->B	C->B	C->B		r=5
r=6						C->B			C->B		r=6
r=7						C->B	C		C->B		r=7
r=8						C->B			C->B		r=8
r=9						C->B	C->B	C->B	C->B	C->B	r=9
r=10											r=10

150188888.txt

COLLISION: A => B (1 => 2)  
COLLISION: C => B (1 => 2)

Time = 2  
- Signal reached from A to B  
- Signal reached from C to B  
- COLLISION occurs! Noted on results file (150188888.txt)  
- The signal from A to B on (2,2) IS NOT SHOWN FOR CLARITY

stations.txt

```
A 3 3 3
B 5 5 3
C 7 7 2
D 2 5 1
```

transmissions.txt

```
A B 1
D C 5
C B 1
B C 3
```

	c=1	c=2	c=3	c=4	c=5	c=6	c=7	c=8	c=9	c=10	
r=1						A->B					r=1
r=2					D	A->B					r=2
r=3			A			A->B					r=3
r=4				B->C	B->C	A->B					r=4
r=5				B->C	B	A->B					r=5
r=6	A->B	A->B	A->B	A->B	A->B	A->B					r=6
r=7							C				r=7
r=8											r=8
r=9											r=9
r=10											r=10

150188888.txt

COLLISION: A => B (1 => 2)  
COLLISION: C => B (1 => 2)

Time = 3  
- Signal from C reached to its transmission range and ceased!  
- Signal from A still propagates  
- Transfer from B to C started

stations.txt

```
A 3 3 3
B 5 5 3
C 7 7 2
D 2 5 1
```

transmissions.txt

```
AB 1
DC 5
CB 1
BC 3
```

	c=1	c=2	c=3	c=4	c=5	c=6	c=7	c=8	c=9	c=10
r=1										
r=2					D					
r=3			A	B->C	B->C	B->C	B->C			
r=4			B->C				B->C			
r=5			B->C		B		B->C			
r=6			B->C				B->C			
r=7			B->C	B->C	B->C	B->C	C			
r=8										
r=9										
r=10										

150188888.txt

COLLISION: A => B (1 => 2)  
COLLISION: C => B (1 => 2)  
SUCCESS: B => C (3 => 4)

Time = 4

- Signal reached from B to C successfully and noted on results file
- The signal from B to C on (3,3) IS NOT SHOWN FOR CLARITY
- Signal from A reached to its transmission range and ceased!

stations.txt

```
A 3 3 3
B 5 5 3
C 7 7 2
D 2 5 1
```

transmissions.txt

```
AB 1
DC 5
CB 1
BC 3
```

	c=1	c=2	c=3	c=4	c=5	c=6	c=7	c=8	c=9	c=10
r=1				D->C	D->C	D->C				
r=2		B->C	B->C	B->C	D	B->C	B->C	B->C		
r=3		B->C	A	D->C	D->C	D->C		B->C		
r=4		B->C						B->C		
r=5		B->C			B			B->C		
r=6		B->C						B->C		
r=7		B->C					C	B->C		
r=8		B->C	B->C	B->C	B->C	B->C	B->C	B->C		
r=9										
r=10										

150188888.txt

COLLISION: A => B (1 => 2)  
COLLISION: C => B (1 => 2)  
SUCCESS: B => C (3 => 4)  
OOR: D => C (5 => 5)

Time = 5

- The signal from B to C on (2,5) IS NOT SHOWN FOR CLARITY
- Transfer from D to C started
- The range of D is reached and the receiver (station C) is out-of-range! OOR failure is noted on results file!

stations.txt

```
A 3 3 3
B 5 5 3
C 7 7 2
D 2 5 1
```

transmissions.txt

```
AB 1
DC 5
CB 1
BC 3
```

	c=1	c=2	c=3	c=4	c=5	c=6	c=7	c=8	c=9	c=10
r=1										
r=2					D					
r=3			A							
r=4										
r=5					B					
r=6										
r=7							C			
r=8										
r=9										
r=10										

150188888.txt

COLLISION: A => B (1 => 2)  
COLLISION: C => B (1 => 2)  
SUCCESS: B => C (3 => 4)  
OOR: D => C (5 => 5)

Time = 6

- Signal from B reached to its transmission range and ceased!
- Signal from D reached to its transmission range and ceased!
- There is no other event, program terminates!