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Department of Computer Science

CS 429/529 – Dynamic and Social Network Analysis

Assignment 2

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EXERCISE 1:

In this assignment, the given data was *People x Event* network. While importing the data, I was also able to create *Event x People* network via the data import wizard of ORA. However, for the *People x People* and *Event x Event* networks, matrix multiplication was needed. By choosing the existing two networks on the left menu, I clicked Matrix Algebra, and multiplied 18x14 People-by-Event with 14x18 Event-by-People network. Therefore, the events were eliminated, and the new 18x18 matrix represented a *People-by-People* network.
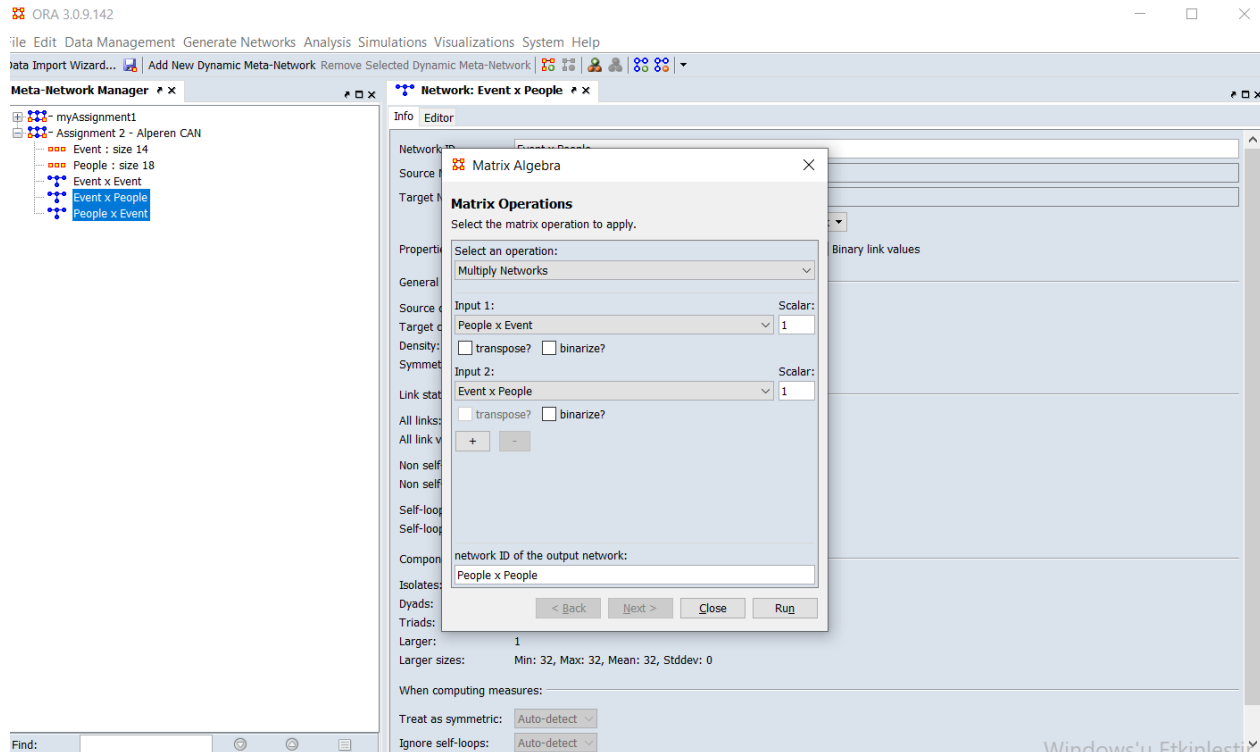

Figure 1: Creating a People x People Network by Using ORA

Following, since the visualization should have readable edge weights as well, I enabled *Show Link Labels* from *Link Appearance* tab as below:
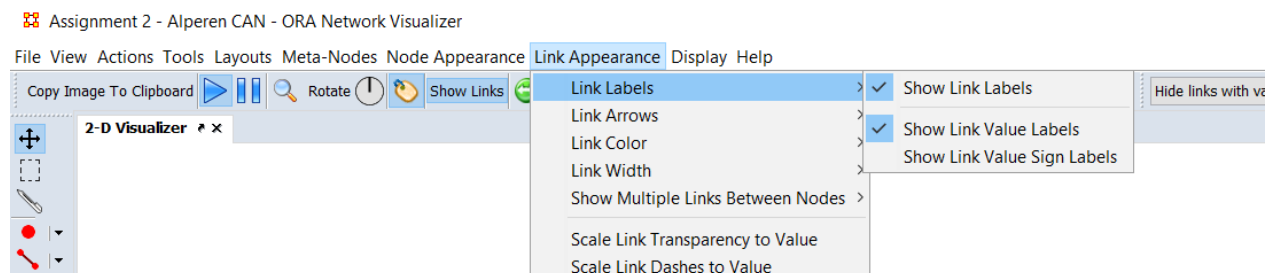

Figure 2: Enabling Link Labels

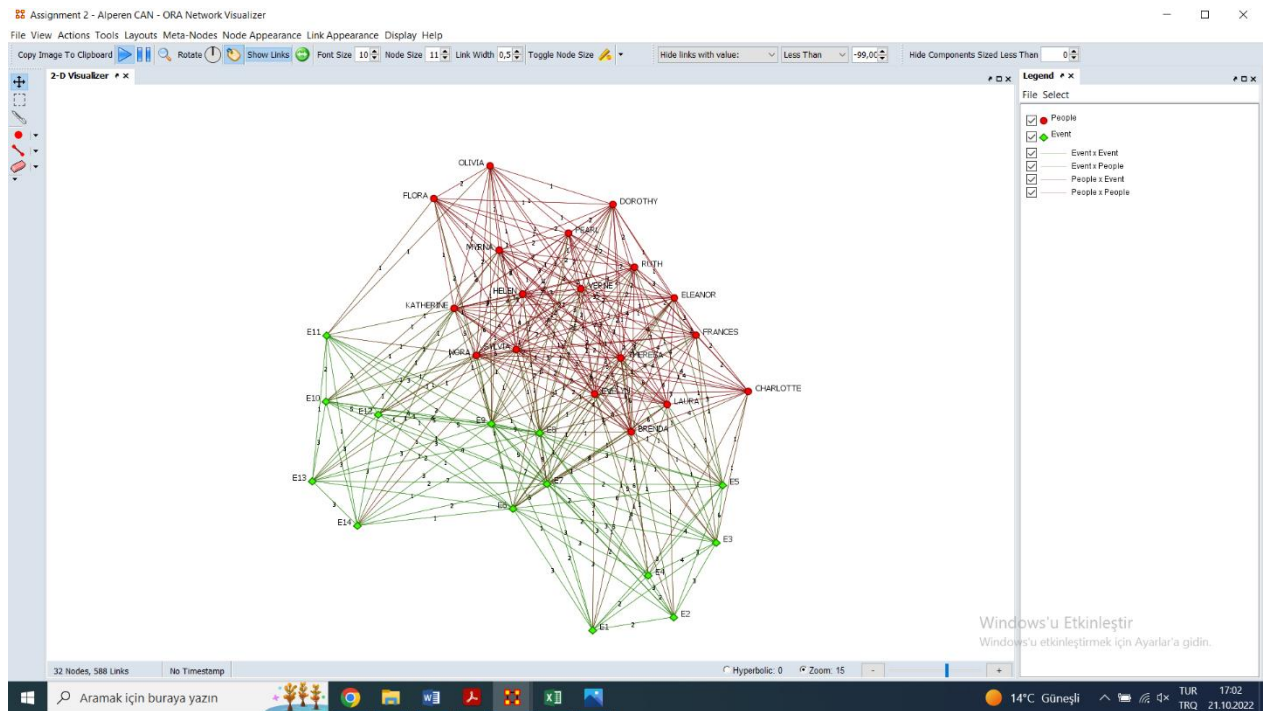Later, the whole meta-network was looking like below:

Figure 3: The Whole Meta-Network with Edge Weights

Having unchecked the *Event* option from right menu, I have obtained the following People-by-People network:
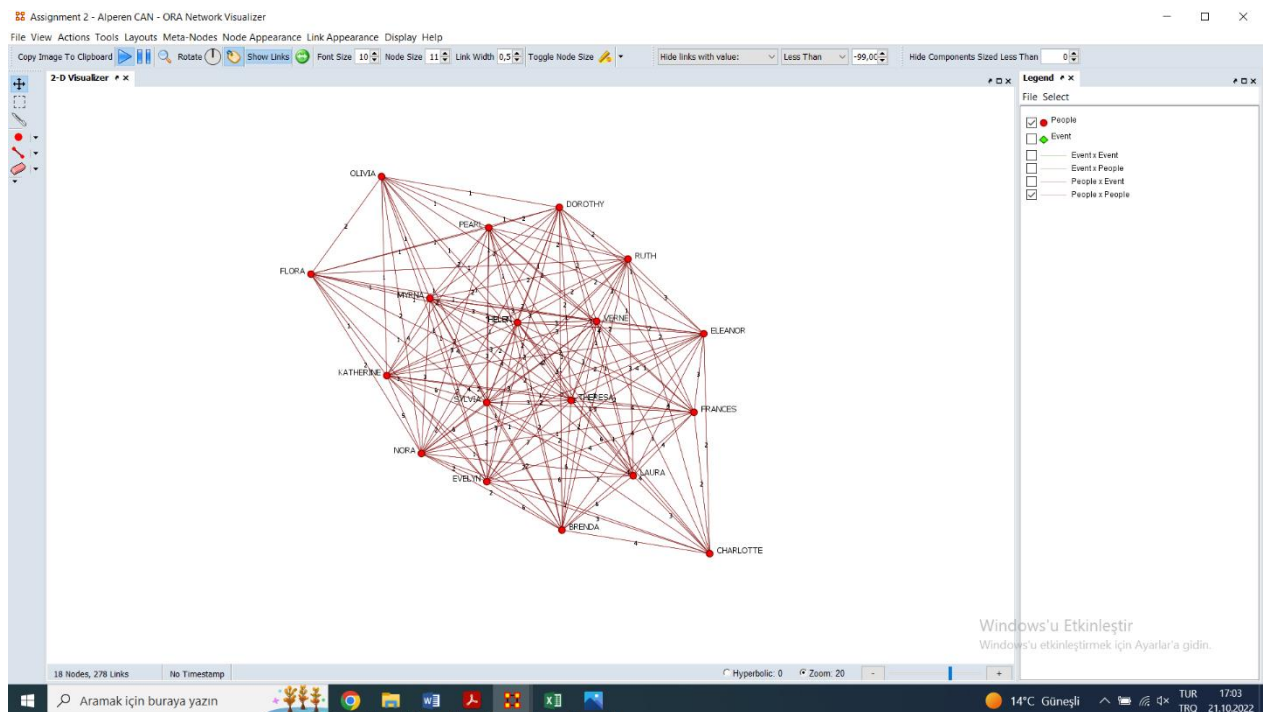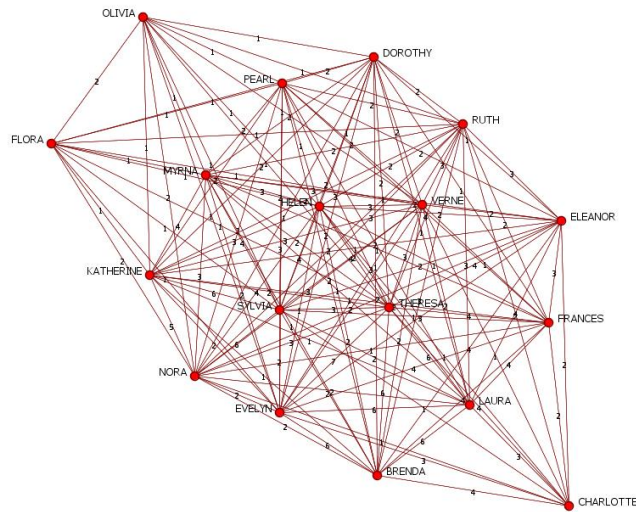

Figure 4: People x People Network with Edge Weights

It can be observed better below in .png format:

powered by ORA

Figure 5: Visualization of People x People Network with Edge Weights in .png Format

Moreover, the generated matrix of People x People network by ORA is as follows:
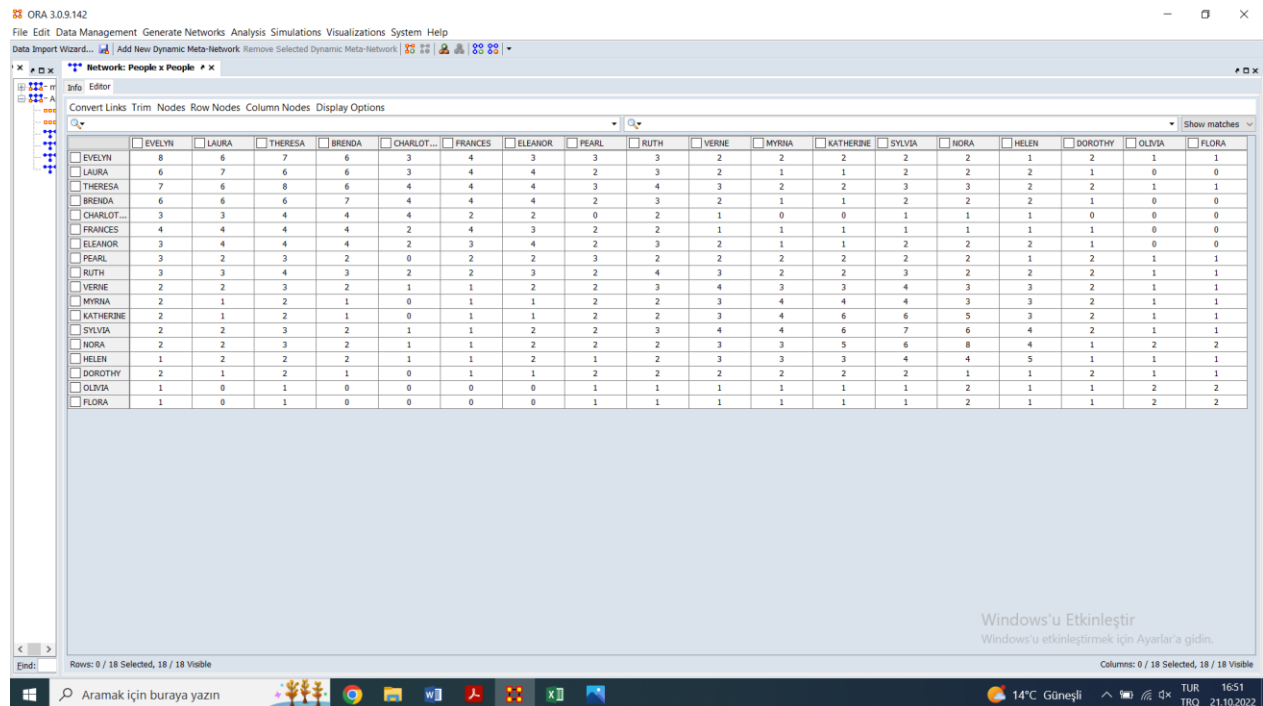

	EVELYN	LAURA	THERESA	BRENDA	CHARLOT...	FRANCES	ELEANOR	PEARL	RUTH	VERNE	MYRNA	KATHERINE	SYLVIA	NORA	HELEN	DOROTHY	OLIVIA	FLORA
EVELYN	8	6	7	6	3	4	3	3	3	2	2	2	2	2	1	2	1	1
LAURA	6	7	6	6	3	4	4	2	3	2	1	1	2	2	2	1	0	0
THERESA	7	6	8	6	4	4	4	3	4	3	2	2	3	3	2	2	1	1
BRENDA	6	6	6	7	4	4	4	2	3	2	1	1	2	2	2	1	0	0
CHARLOT...	3	3	4	4	4	2	2	0	2	1	0	0	1	1	1	0	0	0
FRANCES	4	4	4	4	2	4	3	2	2	1	1	1	1	1	1	1	0	0
ELEANOR	3	4	4	4	2	3	4	2	3	2	1	1	2	2	2	1	0	0
PEARL	3	2	3	2	0	2	2	3	2	2	2	2	2	2	1	2	1	1
RUTH	3	3	4	3	2	2	3	2	4	3	2	2	3	2	2	2	1	1
VERNE	2	2	3	2	1	1	2	2	3	4	3	3	4	3	3	2	1	1
MYRNA	2	1	2	1	0	1	1	2	2	3	4	4	4	3	3	2	1	1
KATHERINE	2	1	2	1	0	1	1	2	2	3	4	6	6	5	3	2	1	1
SYLVIA	2	2	3	2	1	1	2	2	3	4	4	6	7	6	4	2	1	1
NORA	2	2	3	2	1	1	2	2	2	3	3	5	6	8	4	1	2	2
HELEN	1	2	2	2	1	1	2	1	2	3	3	3	4	4	5	1	1	1
DOROTHY	2	1	2	1	0	1	1	2	2	2	2	2	2	1	1	2	1	1
OLIVIA	1	0	1	0	0	0	0	1	1	1	1	1	1	2	1	1	2	2
FLORA	1	0	1	0	0	0	0	1	1	1	1	1	1	2	1	1	2	2

Figure 6: The Generated Matrix of People-by-People Network by ORA

However, since it is asked to have an <u>adjacency matrix</u> in the homework, *from the Convert Links* tab, I have crated the People-by-People matrix with Boolean values like below:
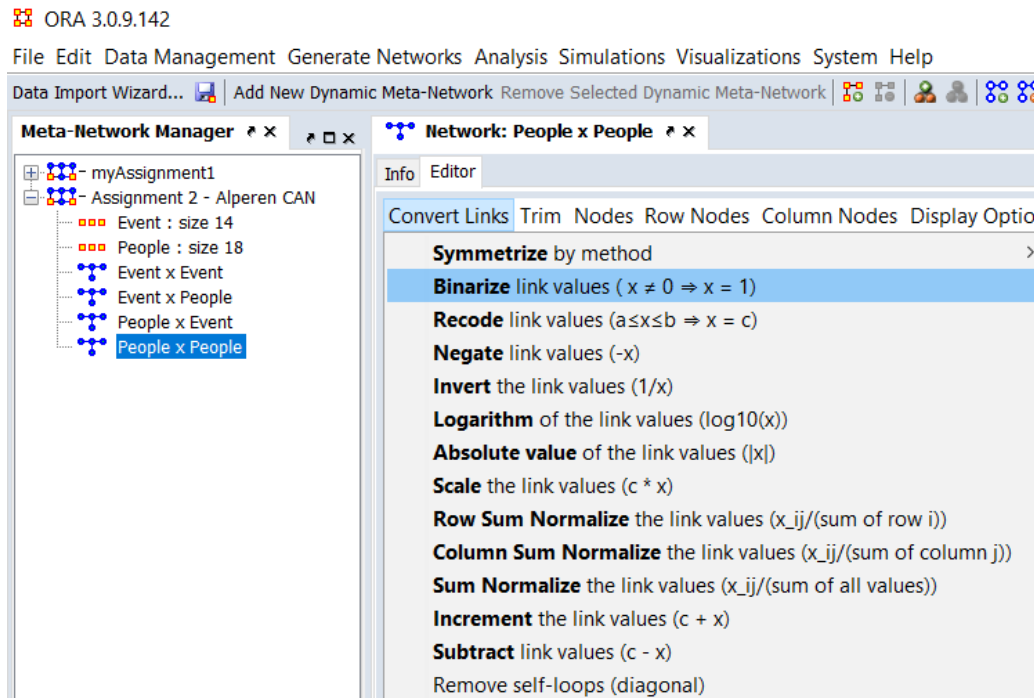

Figure 7: Converting the Matrix to Adjacency Matrix

As a result, the adjacency matrix created by ORA is as follows:

	EVELYN	LAURA	THERESA	BRENDA	CHARLOT...	FRANCES	ELEANOR	PEARL	RUTH	VERNE	MYRNA	KATHERINE	SYLVIA	NORA	HELEN	DOROTHY	OLIVIA	FLORA
EVELYN	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
LAURA	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0
THERESA	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
BRENDA	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0
CHARLOT...	1	1	1	1	1	1	1	0	1	1	0	0	1	1	1	0	0	0
FRANCES	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0
ELEANOR	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0
PEARL	1	1	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1
RUTH	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
VERNE	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
MYRNA	1	1	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1
KATHERINE	1	1	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1
SYLVIA	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
NORA	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
HELEN	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
DOROTHY	1	1	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1
OLIVIA	1	0	1	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1
FLORA	1	0	1	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1

Figure 8: Adjacency Matrix of People-by-People Network

Thus, Question 1 of Exercise 1 has been completed.

Similarly, for the Event x Event Network, I have multiplied 14x18 Event-by-People network with 18x14 People-by-Event network. Therefore, the people were eliminated, and the new 14x14 matrix represented an *Event-by-Event* network. Having unchecked the *People* option from right menu, I have obtained the following Event-by-Event network:
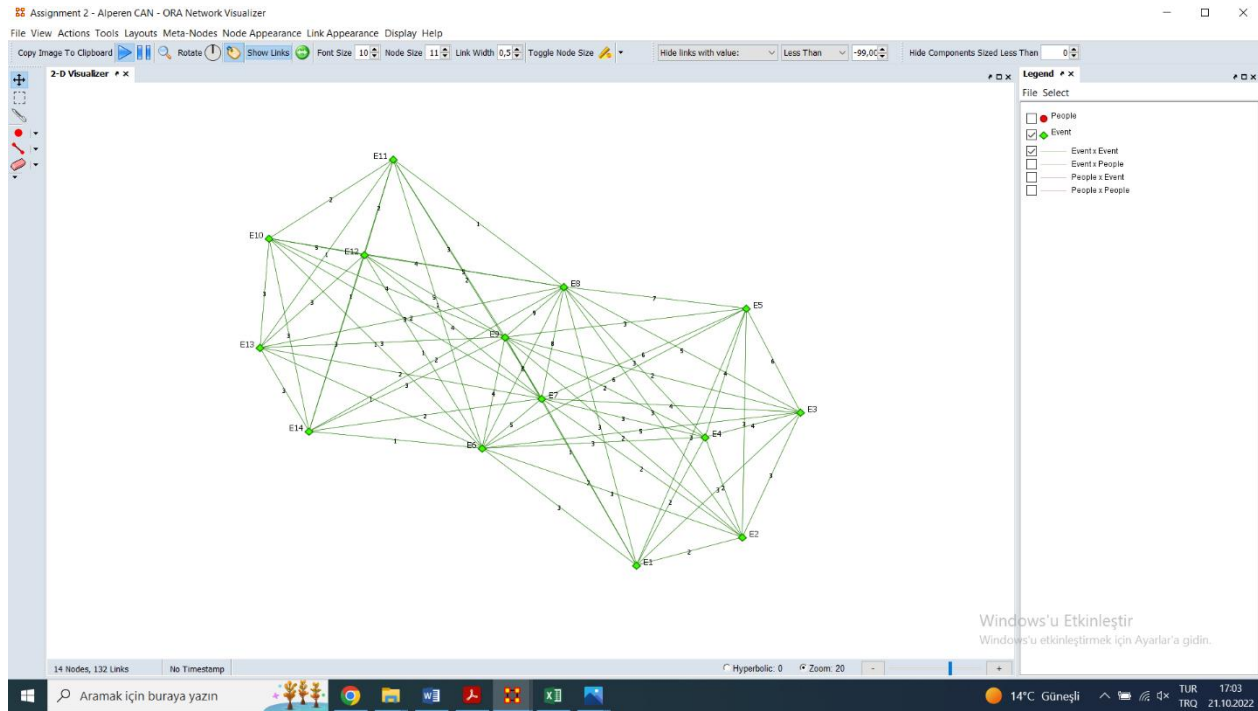

Figure 9: Event-by-Event Network with Edge Weights

It can be observed better below in .png format:

Figure 10: Event-by-Event Network with Edge Weights in .png Format

Moreover, the generated matrix of Event x Event network by ORA is below.

Note that due to the given data, ORA has created the event network with a **different** order. For instance, E7 is not between E6 and E8, but the matrix is correct.
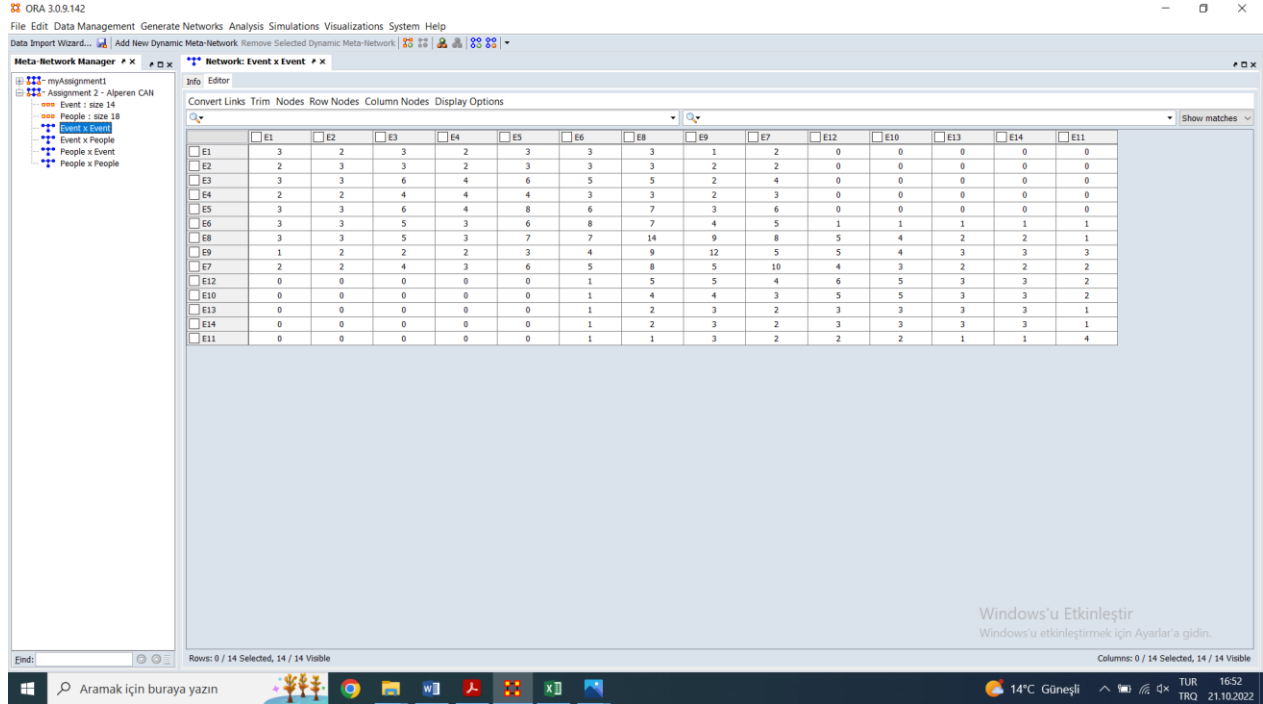
	E1	E2	E3	E4	E5	E6	E8	E9	E7	E12	E10	E13	E14	E11
E1	3	2	3	2	3	3	3	1	2	0	0	0	0	0
E2	2	3	3	2	3	3	3	2	2	0	0	0	0	0
E3	3	3	6	4	6	5	5	2	4	0	0	0	0	0
E4	2	2	4	4	4	3	3	2	3	0	0	0	0	0
E5	3	3	6	4	8	6	7	3	6	0	0	0	0	0
E6	3	3	5	3	6	8	7	4	5	1	1	1	1	1
E8	3	3	5	3	7	7	14	9	8	5	4	2	2	1
E9	1	2	2	2	3	4	9	12	5	5	4	3	3	3
E7	2	2	4	3	6	5	8	5	10	4	3	2	2	2
E12	0	0	0	0	0	1	5	4	4	6	5	3	3	2
E10	0	0	0	0	0	1	4	4	3	5	5	3	3	2
E13	0	0	0	0	0	1	2	3	2	3	3	3	3	1
E14	0	0	0	0	0	1	2	3	2	3	3	3	3	1
E11	0	0	0	0	0	1	1	3	2	2	2	1	1	4

Figure 11: The Generated Matrix of Event-by-Event Network by ORA

However, since it is asked to have an adjacency matrix in the homework, *from the Convert Links* tab, I have crated the Event-by-Event matrix with Boolean values. The adjacency network is as follows:

	E1	E2	E3	E4	E5	E6	E8	E9	E7	E12	E10	E13	E14	E11
E1	1	1	1	1	1	1	1	1	1	0	0	0	0	0
E2	1	1	1	1	1	1	1	1	1	0	0	0	0	0
E3	1	1	1	1	1	1	1	1	1	0	0	0	0	0
E4	1	1	1	1	1	1	1	1	1	0	0	0	0	0
E5	1	1	1	1	1	1	1	1	1	0	0	0	0	0
E6	1	1	1	1	1	1	1	1	1	1	1	1	1	1
E8	1	1	1	1	1	1	1	1	1	1	1	1	1	1
E9	1	1	1	1	1	1	1	1	1	1	1	1	1	1
E7	1	1	1	1	1	1	1	1	1	1	1	1	1	1
E12	0	0	0	0	0	1	1	1	1	1	1	1	1	1
E10	0	0	0	0	0	1	1	1	1	1	1	1	1	1
E13	0	0	0	0	0	1	1	1	1	1	1	1	1	1
E14	0	0	0	0	0	1	1	1	1	1	1	1	1	1
E11	0	0	0	0	0	1	1	1	1	1	1	1	1	1

Figure 12: Adjacency Matrix of Event-by-Event Network

Hence, Question 2 of Exercise 1 has also completed.

EXERCISE 2:

1) People x People network indicates the people who have attended the same events. In other words, if two people have a link between them, it means that there is at least one event that both of these people have attended.
   To be more specific, people-by-people network may represent,
   - The people who attended the same concerts,
   - The actors who played in the same movies,
   - The authors who contributed to the same papers, etc.

2) The edge weights in the People x People network indicates the number of common events that two people attended.
   To clarify, for instance, on *figure 5*, we see that Olivia and Flora is connected, and the link has the value 2 as a weight. It indicates that they have attended 2 events together. Indeed, they only have 2 common events, which are E9 and E11.

3) From the matrix, we are able to see that the network contains self-loops, that is, A_{ii} contains a value different than 0. For instance, we see that $A_{Laura\ Laura}$ = 7, and $A_{Olivia\ Olivia}$ = 2. Therefore, we can infer that the values on the self-loops indicates the number of events that this person attended. Indeed, from the dataset we see that Laura attended 7 events in total and Olivia attended total 2 events.

EXERCISE 3:

1) Event x Event network indicates the events having the same attendees. In other words, if two events have a link between them, it means that there is at least one person who attended both of these events.
   To be more specific, event-by-event network may represent,
   - Concerts that the same people attended,
   - Movies that the same actors have played together,
   - Papers which have the same contributors, etc.

2) The edge weights in the Event x Event network indicates the number of people who attended both of these two events.
   To clarify, for instance, on *figure 10*, we see that E2 and E3 is connected, and the link has the value 3 as a weight. It indicates that these two events have 3 common attendees. Indeed, there are only 3 common participants who attended both E2 and E3, who are Evelyn, Laura and Theresa.

3) From the matrix, we are able to see that the network contains self-loops, that is, A_{ii} contains a value different than 0. For instance, we see that $E_{2\ 2}$ = 3, and $E_{4\ 4}$ = 4. Therefore, we can infer that the values on the self-loops indicates the number of people who attended to this event. Indeed, from the dataset we see that E2 has 3 attendees who are Evelyn, Laura and Theresa; and E4 has 4 attendees in total who are Evelyn, Theresa, Brenda, Charlotte.