How to use RanGen1 and RanGen2?

On the webpage www.projectmanagement.ugent.be/rangen.php, you can download our two network generators to construct project networks under a controlled design. Both generators rely on the same and efficient principle proposed by Demeulemeester, Vanhoucke and Herroelen (2003). Each generator has two types of input parameters: parameters measuring the topological structure of a network and resource related parameters. The choice between RanGen1 and RanGen2 is completely determined by the input parameters measuring the topological structure, and needs to be done at the welcome page of the program.





RanGen1:

- Number of activities
- Order Strength (OS): the number of precedence relations (including the transitive ones but not including the arcs connecting the dummy start or end activity) divided by the theoretical maximum number of precedence relations in the network
- Complexity Index (CI): measure of the closeness of a network to a series-parallel directed graph

The generation process of RanGen1 is based on <u>two input parameters</u> (the number of activities and the order strength). The generator will generate a <u>pre-specified number of networks</u> in a very short time, and will calculate the complexity index of each network. In doing so, the user can save networks with given values for the three parameters measuring the topological structure of a network. The user can

save networks with a given input value for the number of activities and the order strength and can choose among the CI values as indicated in the <u>morphological measure</u> window.

RanGen	
Program Options Help	
Welcome Max # Networks Input Parameters Resource Related Measures Morphological Measures	
Number of activities: 10	
OS value: 1	
G	enerate

Figure 2. Two input parameters of RanGen1

Figure 3. Pre-specified number of networks in RanGen1



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√elcome Max # Networks	Input Parameters Resource	Related Measures Morphole	ogical Measures	
Low:	High:	# networks:		
			[
			Ge	enerate

Figure 4. Morphological measure window in RanGen1

RanGen2:

- I1: Number of activities
- I2: Serial/Parallel indicator: measures whether the network is close to a serial network (a chain of activities) of close to a parallel network (no precedence relations)
- I3: Activity distribution: measures the distribution of the activities over the network
- I4: Short precedence relations: measures the presence of short precedence relations
- I5: Long precedence relations: measures the presence of all precedence relations
- I6: Topological float: measures the topological float of activities in the network

The generation process of RanGen2 is based on <u>two input parameters</u> (the number of activities I1 and the serial/parallel indicator I2). The generator will generate a <u>pre-specified number of networks</u> in a very short time, and will calculate the I3, I4, I5 and I6 values for each network. In doing so, the user can save networks with given values for the six parameters measuring the topological structure of a network. The user can save networks with a given input values for the I1 and I2 indicators and can choose among the I3, I4, I5 and I6 values as indicated in the <u>morphological measure</u> window.

Figure 5. Tw	o input paramete	ers of RanGen2
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RanGen	
Yrogram Options Help	
Welcome Max # Networks Input Parameters Resource Related Measures Morphological Measures	
Number of activities: 10	
I2 value: 1	
G	enerate

Figure 6. Pre-specified number of networks in RanGen2

RanGen	
ogram Options Help	
Welcome Max # Networks Input Parameters Resource Related Measures Morphological Measures	
1 I imelimit	
Timelimit in seconds: 600	
Maximum number of generated networks: 1000	
G	enerate

C RanGen		
Program Options Help		
Welcome Max # Networks In	put Parameters Resource Related Measures Morphological M	leasures
# Networks:		
I3	14	
	High:	High:
		1
	Low:	Low:
15		
	High:	High:
	Low:	Low:
		Generate

Figure 7. Morphological measure window in RanGen2

Resource related measures for RanGen1 and RanGen2

The <u>"resource related measures</u>" link consists of three types of resource related parameters from which the user can choose:

- Number of resources
- Resource requirements: option between resource factor (RF) and resource use (RU)
- Resource demand: option between resource constrainedness (RC) or resource strength (RS)

Brogram Options Help Welcome Max # Networks Input Parameters Resource Related Measures Morphological Measures Number of resources: 4 • Resource request measures: Resource factor (RF) • Value for the resource use; 4 • Value for the resource use; 4 • Value for the resource use; 4 • Value for the resource constrainedness: 1 • Value for the resource strength: 1 •	RanGen	
Welcome Max # Networks Input Parameters Resource Related Measures Number of resources: 4 • Resource request measures: Resource factor (RF) • Value for the resource data • • Value for the resource use: • • Value for the resource constrainedness: • • Value for the resource constrainedness: • • Value for the resource strength: • •	Program Options Help	
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Number of resources:		
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Value for the resource factor: 1 Value for the resource use: 4 Resource demand measures: Resource constrainedness (1 Value for the resource constrainedness: 1 Value for the resource strength: 1 Value for the resource streng	Resource request measures: Resource factor (RF)	
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Value for the resource strength:	Resource demand measures: Resource constrainedness (I 💌	
Value for the resource strength:	Value for the resource constrainedness:	
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	Value for the resource strength:	
Generation		Generate
		ueneiale

Figure 8. Resource related measures

Saving the networks on your PC

After each generation process the generators have generated a large amount of networks with given values for the two input parameters as mentioned earlier. The other parameters (CI for RanGen1 and I3, I4, I5 and I6 for RanGen2) can be changed by the user each time networks have been saved. Each time a set of indicator values have been chosen (CI or I3, I4, I5 and I6), the <u>"save files"</u> window will pop up. By changing the value for the start file, the generated network files will be numbered according to the wish of the user. This allows the user to easily generate a large amount of networks with different values for these parameters without a new generation run. In order to generate networks with different values for the two input parameters, the user needs to run a simulation for each value of the input parameter.

11: 9		
I2: 1		
13: between 0 a	nd 1	
I4: between 0 a	nd 1	
15: between 0 a	nd 1	
I6: between 0 a	nd 1	
Number of reso	ources: 4	
Number of reso Value for the re	ources: 4 esource factor: 1	
Number of reso Value for the ro Value for the ro	ources: 4 esource factor: 1 esource constrainedness:	1
Number of resc Value for the re Value for the re	ources: 4 esource factor: 1 esource constrainedness:	1
Number of reso Value for the re Value for the re Temp directory:	purces: 4 esource factor: 1 esource constrainedness: C:\RanGen\Output	1
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References

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Vanhoucke, M., Coelho, J., Tavares, L. and Debels, D., 2004, "An evaluation of the adequacy of network generators with systematically sampled networks", Working paper 04/272, Ghent University (under submission in Networks)