Group 9: Condensed Connections- Exploring Bose-Einstein Condensates with Bianconi-Barabasi Networks

**Background of our project:** The Barabasi-Albert model does not take into account nodes which might emerge later and could also have the potential to take over so then we take an extended version of in the Bianconi barabasi model which gives us a fitness of the network, upon which we can experiment with phase transitions as well as the network might have a critical value which in the application on the bose Einstein condenstate helps us to observe phase transitions (e.g. Google in the internet network)

**Research question:** How the degree distribution in the Bianconi barabasi model depends on the change of the fitness distribution in the network. Subsequently how the network in the case of Bose Einstein condenstate, affects the phase transition in the network

**Hypotheses:** The degree distribution will follow a power-law, precisely like the BA model, if the fitness distribution has a finite domain. The node with the highest fitness value will draw a lot of other nodes in the second instance if the fitness distribution has an unlimited domain, resulting in a situation where the winner takes it all.

**Which model**. Bianconi-Barabasi network, Bose-einstein condensation.

**Emergent phenomenon of focus:** Phase transition. Degree distribution plots wrt fitness (Network analysis). Degree distribution plots wrt temperature drop (Bose-Einstein condensation).

**References:**

Bianconi, & Barabási, A.-L. (2001). Competition and multiscaling in evolving networks. Europhysics Letters, 54(4), 436–442. <https://doi.org/10.1209/epl/i2001-00260-6>

Bianconi, & Barabási, A. L. (2001). Bose-Einstein condensation in complex networks. Physical Review Letters, 86(24), 5632–5635. <https://doi.org/10.1103/PhysRevLett.86.5632>

Progress/time planning

**Week 1:**

* **Monday**: Refine project deliverables. Discuss how planning is gonna go, distribute implementation work to group members.
  + Who is working out the math?
  + Who is working out the network implementation?
  + …
* **Tuesday**: Implement Network model, look into what kinds of plots we want.
* **Wednesday:** Continue implementation of the network + Make the first slides of the presentation on the theory of the network
* **Thursday**: Re-evaluate the progress, set nice to haves
* **Friday**: Start looking into Condensation – read articles over the weekend

**Week 2:**

* **Monday:** Start-up meeting: what are we feeling that needs to be done the rest of the week?
* **Tuesdays:** Set definitive deadline for the must haves
* **Wednesday:** Finish the must haves, start making a storyline for the presentation
* **Thursday:** Finish up the plots for the presentation, and the rest of the presentation
* **Friday:** present and code cleanup. We want to be able to hand it in at the end of the day.

Questions/Issues

* How are we plotting the phase transition 🡪 How do you PROVE that it is actually a phase transition?