

# MURI research

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## Multivariate Central Limit Theorem for the degree counts in a preferential attachment model (with Sid Resnick)

- We are given an undirected preferential attachment model.
- For the graph with  $n$  edges, let  $p_i^{(n)}$  be the proportion of the nodes with the total degree  $i$ ,  $i \geq 1$ .
- We establish a process-level CLT of the form

$$\left( \frac{p_i^{(n)} - E p_i^{(n)}}{\sqrt{\text{var}(p_i^{(n)})}}, i = 1, 2, \dots \right) \Rightarrow (G_i, i = 1, 2, \dots),$$

where  $(G_i)$  is a Gaussian process.

## Edge-biased degree distribution and reciprocity

In a directed preferential attachment model, we would like to estimate proportion of edges  $(i, j)$  for which the reversed edge  $(j, i)$  is also present.

As a step to solving this problem, we would like to understand the 4-dimensional heavy tailed distribution  $(i_{in}, i_{out}, j_{in}, j_{out})$  for a randomly chosen edge  $(i, j)$ .