**Erdös Renyi Graph** $G(n,p)$ is constructed in the following manner:

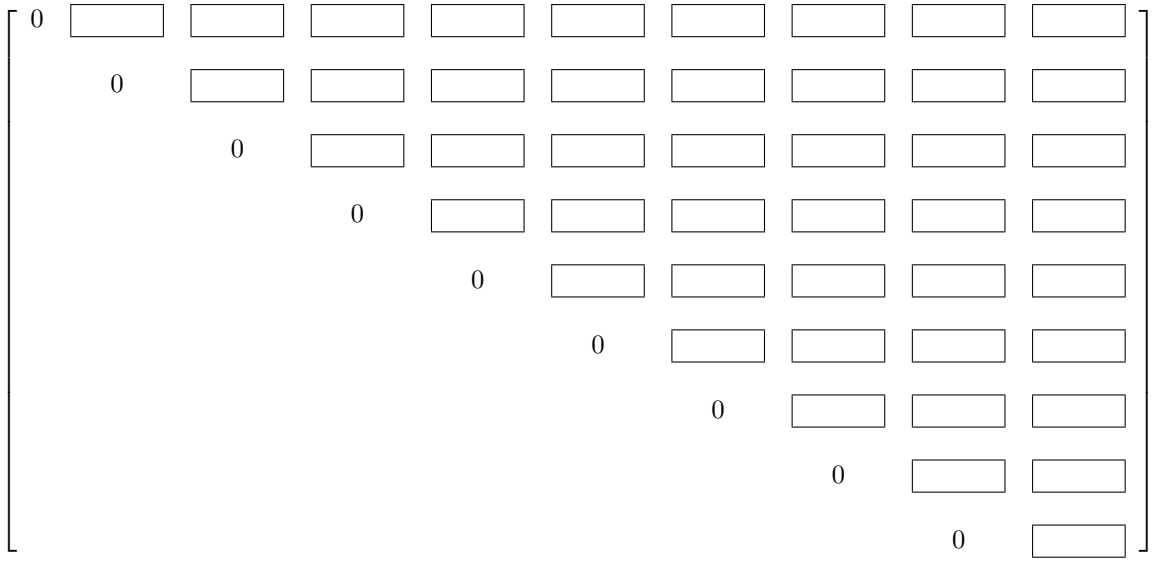
1. Consider $n$ vertices labeled $\{1,2,\ldots,n\}$.

2. Corresponding to each distinct pair $\{i,j\}$ we perform an independent Bernoulli $(p)$ experiment and insert an edge between $i$ and $j$ with probability $p$. Note that all edges are *undirected* and hence there are total of $\binom{n}{2}$ possible edges, each occuring with probability $p$.

3. In this Homework you will simulate an Erdös Renyi Graph and find the M.L.E for the relevant $p$.

   1. Choosing $x$: Write a simple R-code to generate a number uniformly from $\{1,2,3,4,5\}$. Let $x$ denote the chosen number. Record $x$ in the box: [ ].
   2. Consider the experiment of rolling a die and (choose) specify an event from that experiment which occurs with probability $x/6$. Let it be called $B$. Write out the description of the event $B$ in the box below:
      [ ].
   3. The set of vertices for the graph you are about to construct are $\{1,2,\ldots,10\}$. The graph has no self-edges (i.e Self-loops). What is the total number of possible edges ?
      Record answer in the box: [ ]
   4. Construct the *random* adjacency matrix $A$ for the graph as follows. For each pair $1 \le i < j \le 10$: *rolling the die 15 times*(using one at home or at http://www.randomservices.org/random/apps/Dice.html) and observe if the event $B$ has occured.
      Designate
      $$a_{ij} = \begin{cases} 1 & \text{if } B \text{ occured.} \\ 0 & \text{if } B \text{ did not occur} \end{cases}$$

Fill in the matrix entries accordingly:



5. Using the `igraph` package draw the random graph , denote by $G(10, \frac{x}{6})$, corresponding to the above adjacency matrix (i.e draw an edge between $i$ and $j$ if $a_{ij} = 1$). *Send the image of your graph on zoom chat group between 8:15am and 8:30am on May 5th, 2022.*

6. From the graph $G(10, \frac{x}{6})$ or from $A$ that you constructed in the worksheet:

   (a) fill in the following table from the data in worksheet:

| x | # Edges |
|---|---|
| | |

7. Let $E$ denote the number of edges in a realisation of $G(10, \frac{x}{6})$. Find the likelihood $L(x; E)$ that $E$ edges occur in the random Graph $G(10, \frac{x}{6})$.

8. Find $x^*$ that maximizes $L(x; E)$ with respect to $x$. You may assume $x \in [1, 5]$.

9. Substitute your value of $E$ from Question 1, into the expression for $x^*$. Is the resulting $x^*$ close to your chosen $x$ ?