CTTP midterm, 20 March 1996

1. The following C function generates certain type of random numbers. What is the probability distribution $p(r)$ of the random number r? Note that $p(r)\,dr$ is the probability for a random number between r and $r + dr$. Hint: think of the transformation method.

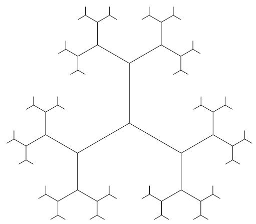
```
#include <math.h>

#define MULTIPLIER  69069
#define UINTMAX  pow(2.0, 32.0)
unsigned int  seed = 1;

double rn(void)
{
   double x, r;

   seed *= MULTIPLIER;
   x = seed / UINTMAX;
   r = x * x;
   return r;
}
```

2. Find the expressions for cluster numbers $n_s(p)$ on Bethe lattice (Cayley tree) shown below for small clusters $s = 1$ and $s = 2$. If you are brave enough and have time, also find that for $s = 3$ and 4.



3. Of course you can generate the distribution

$$p_i = 1/2^i, \qquad i = 1, 2, \ldots$$

by the more efficient transformation method. But you can also apply the Metropolis method. Describe with pseudocode how you can sample the random integer i with Metropolis algorithm. What is your $T(i, j)$ matrix?