N TOTAL NUMBER OF NODES IN THE NETWORK

N_K NUMBER OF NODES WITH DEGREE K

$f_K = \dfrac{N_K}{N}$ FRACTION OF NODES WITH DEGREE K

I_K NUMBER OF NODES INFECTED AMONG THOSE WITH DEGREE K

GIVEN A ~~NO~~ SUSCEPTIBLE NODE i
WITH DEGREE d

THE PROBABILITY THAT A GIVEN
NEIGHBOR WILL INFECT i IS

$$p \frac{\sum_{k} k f_k \frac{I_k}{N_k}}{\sum_{h} h f_h} = p \frac{\sum_{k} k \frac{I_k}{N}}{\langle d \rangle} =$$

$$\stackrel{\Delta}{=} p \, \Theta(t)$$

WHERE $\Theta(t)$ IS THE PROBABILITY THAT THE NEIGHBOR
IS INFECTED

THE PROBABILITY THAT A
NEIGHBOR WILL INFECT i IS

$$\simeq p d \, \Theta(t)$$

IN THE NETWORK THE NUMBER
OF NODES WITH DEGREE d AND
SUSCEPTIBLE IS

$$N_d - I_d$$

THEN THE AVERAGE NUMBER OF
THEM INFECTED DURING A TIMESLOT IS

$$(N_d - I_d) \, p d \, \Theta(t)$$

THE CORRESPONDING DIFFERENTIAL EQUATION IS

$$\frac{dI_d}{dt} = (N_d - I_d)\, p\, d\, \Theta(t)$$

AT THE BEGIN OF THE INFECTION IT IS

$I_d \ll N_d$, THEN

$$\frac{dI_d}{dt} \simeq N_d\, p\, d\, \Theta(t)$$

$$\frac{d\Theta}{dt} = \sum_d d\, \frac{\frac{dI_d}{dt}}{N\langle d\rangle} \simeq$$

$$= \sum_d \frac{d\, N_d\, p\, d\, \Theta(t)}{N\langle d\rangle} =$$

$$= \sum_d \frac{f_d\, d^2}{\langle d\rangle}\, \Theta(t) =$$

$$= \frac{\langle d^2\rangle}{\langle d\rangle}\, \Theta(t)$$

$$\Theta(t) \simeq \Theta(0)\, e^{+\frac{\langle d^2\rangle}{\langle d\rangle} t}$$

FOR A REGULAR GRAPH IT IS

$\langle d^2 \rangle = \langle d \rangle^2$

IN GENERAL IT IS

$\langle d^2 \rangle = \langle d \rangle^2 + Var(d)$

VARIANCE

THEN THE INFECTION GROWS FASTER, THE LARGER THE VARIABILITY OF THE DEGREE

IN POWER-LAW GRAPH $(P(d) \sim d^{-\alpha})$

$Var(d) \gg \langle d \rangle^2$

AND THE INFECTION CAN BE ORDERS OF MAGNITUDE FASTER THAN IN A REGULAR GRAPH OR IN A GRAPH WITH HOMOGENEOUS DEGREES