“R_0” Factor

The R0 Factor

- While often called the “R” factor, that term is ***ambiguous***,
- there are many, different interpretations

- So, we will use the ***more*** correct term R0 factor (or R_0)
- This is the reproductive number of an infection spreading

The R0 Factor

- There have been, and will be, many infectious disease spreading
- This isn't new, has been around for millennia, and will continue to be an issue in the future
- People are "social"
- We tend to be around other people much of the time

The R0 Factor

- There have been, and will be, many infectious disease spreading
- Some very notable disease spreadings
  - Recent
  - 2003 SARS
  - 2009 H1N1 (Flu)
  - 2014 Ebola

  - Past
  - 1918 Flu
  - 1346 “The Plague”

The R0 Factor

- There have been, and will be, many infectious disease spreading
- Some very notable disease spreadings

- Pandemic – Epidemic in multiple countries

- https://www.livescience.com/worst-epidemics-and-pandemics-in-history.html

The R0 Factor

- The R0 factor is the reproduction number of a disease
- (or other, similar)

- It is how much one person transmits the disease to others

- It is mitigated by some people who are vaccinated (if possible)
- Or are already immune (previously exposed or naturally immune)

The R0 Factor

- The R0 factor is the reproduction number of a disease

- So, for example
- R0 equal to 2, means each person spreads the disease to two others
- R0 equal to 0.5, means each 2 infected spread to only one (new, additional) other person

The R0 Factor

- The R0 factor is the reproduction number of a disease
- So, if R0 is
  - Less than 1.0, the spread of the disease will decline, and it will go away
  - Equal to 1.0, the disease stays around (in the population) but won't become an epidemic
  - Greater than 1.0, the disease will spread, and possibly become an epidemic (or pandemic)

The R0 Factor

- The R0 factor is the reproduction number of a disease
- So, if R0 is
  - 0.5, then if the “incubation period” (time between exposure and symptoms of illness – that is when a person is sick) is 5 days
  - Then the disease will spread from 100 people to 50 additional (new) who will get sick, then to 25, then to 12, every 5 days
  - The disease will “go away”

The R0 Factor

- The R0 factor is the reproduction number of a disease
- So, if R0 is
  - 2.0, then if the “incubation period” (time between exposure and symptoms of illness – that is when a person is sick) is 5 days
  - Then the disease will spread from 100 people to 200 additional (new) who will get sick, then to 400, then to 800, every 5 days
  - The disease will rapidly spread

The R0 Factor

- The R0 factor is the reproduction number of a disease
- So, what can be done?

- Reduce the exposure rate, reduce R0 by minimizing contacts
- Or
- Increase the exposure rate, so that the group (population) has a large amount of exposure, and the disease has nowhere to spread, this is “herd” immunity (or “herd protection”)

The R0 Factor

- The R0 factor is the reproduction number of a disease
- So, what can be done?

- Get better understanding
  - actual R0 rates?
  - actual incubation period (time)?
  - Are there people naturally immune?
  - Can people get re-infected?
  - Are there people who are infected who show no symptoms (asymptomatic)?

The R0 Factor

- Get better understanding
- Need to get a good (quantifiable) understanding
- Then can build models, and proceed

- There are smart people who are doing this

The R0 Factor

- https://sph.umich.edu/pursuit/2020posts/how-scientists-quantify-outbreaks.html
- https://www.healthline.com/health/r-nought-reproduction-number#meaning
- https://www.ncbi.nlm.nih.gov/pubmed/32097725

The R0 Factor

- How does this have anything to do with Computer Science?

- Lots!
- Viral algorithms or methods

The R0 Factor

- A very similar process is used to spread rumors
- Rumors are spread between people individually or often “published” on the Internet, newspapers, TV, Facebook, Twitter…
- “The disease was created by extra-terrestrial aliens”
- “in a laboratory”
- “can be cured by drinking (ingesting) disinfectants”
- … many, many more

The R0 Factor

- A very similar process is used to spread rumors
- Rumors fill a very strong need “to be in the know”
- There are many books, articles, publications about how influential they are
- Even if, maybe especially if, they are “crazy” or “wrong”

The R0 Factor

- “This class is an easy “A””
- “There will be additional sections of the class offered”
- “There is no penalty for collaboration (cheating), so try it”
- …
- Many, many more (the previous are ***examples***, ***not real***)

The R0 Factor

- How does this have anything to do with Computer Science?

- Lots!
- Viral algorithms or methods

The R0 Factor

- In a loosely connected network or group of computers, we want to distribute updated information
  - Security patches
  - Login and authentication
  - Routing tables

The R0 Factor

- We want to search for something
  - Keywords or groups of keywords in documents
  - Tuples in distributed or separated data bases
  - Duplicated (or partially) information on many computers
  - …

The R0 Factor

- How is Malware spread?
- Who is infected (and how)?

- How can we stop it from spreading?

RO

- Need to understand
  - Get data (testing, reporting. etc)
  - Quantify data
- Build Models

Last

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