Only maths can Save you from the Zombie apocalypse

Key Stage 4 Programme

Pupil Name	Name
Handbook Designed by	Dr Siben Li

Timetable and Assignment Submission

Timetable – Tutorials

Tutorial	Date	Time	Location
1			
2			
3			
4			
5			
6 (Feedback)			

Timetable – Homework Assignments

Homework Assignment	Description	Due Date
Tutorial 1		
Tutorial 2		
Tutorial 3		
Tutorial 4		
Tutorial 5		

Assignment Submission – Lateness and Plagiarism

Lateness	
Submission after deadline	10 marks deducted
Plagiarism	
Some plagiarism	10 marks deducted
Moderate plagiarism	20 marks deducted
Extreme plagiarism	Automatic fail

The Brilliant Club KS5 Programme – Pupil Feedback Report

Grade	Marks	What this means
1st	70+	Performing to an excellent standard at A-level
2:1	60-69	Performing to a good standard at AS-level
2:2	50-59	Performing to an excellent standard at GCSE
3rd	40-49	Performing to a good standard at GCSE
Working towards a pass	0-39	Performing below a good standard at GCSE
Did not submit	DNS	No assignment received by The Brilliant Club

Lateness	
Any lateness	10 marks deducted
Plagiarism	
Some plagiarism	10 marks deducted
Moderate plagiarism	20 marks deducted
Extreme plagiarism	Automatic fail

Name of PhD Tutor			
Title of Assignment			
Name of Pupil			
Name of School			
ORIGINAL MARK / 100		FINAL MARK / 100	
DEDUCTED MARKS		FINAL GRADE	

If marks have been deducted (e.g. late submission, plagiarism) the PhD tutor should give an explanation in this section:

Learning Feedback Comment 1 -	
What you did in relation to this Key Learning Priority	How you could improve in the future
Learning Feedback Comment 2 –	
What you did in relation to this Key Learning Priority	How you could improve in the future
Learning Feedback Comment 3 –	
What you did in relation to this Key Learning Priority	How you could improve in the future
Resilience Comment	
How you showed learning resilience during the course	How you could build learning resilience in the future

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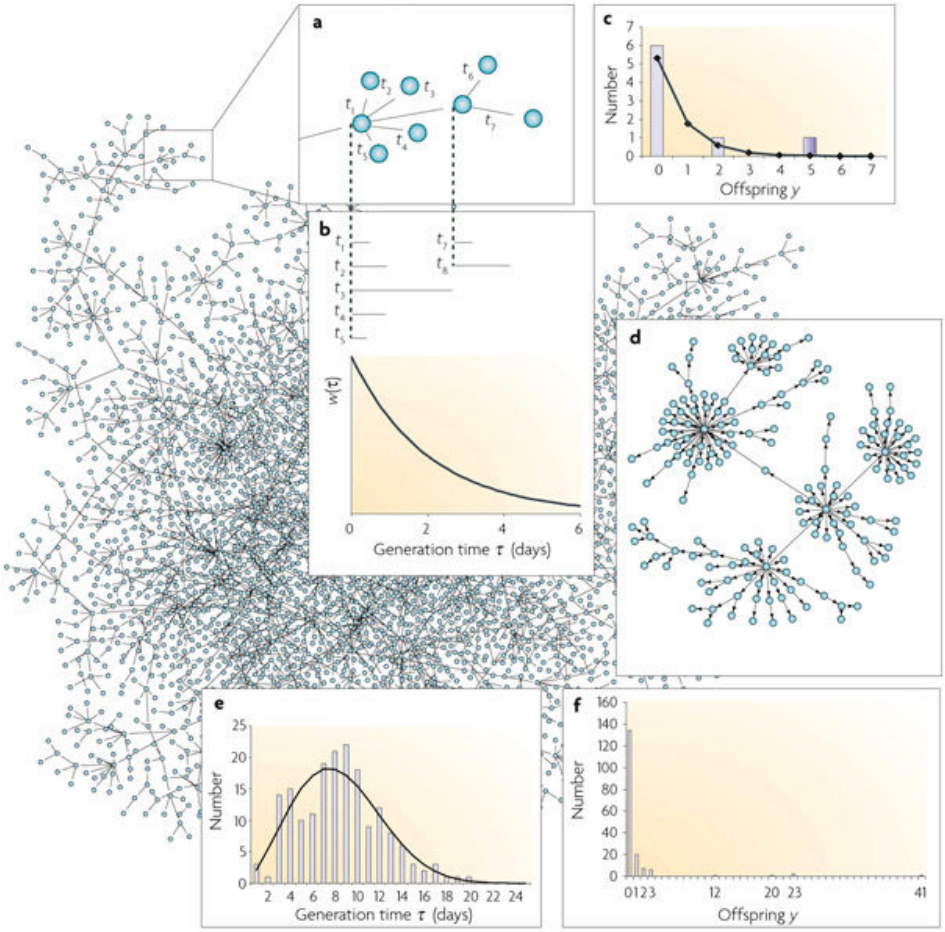
Course Rationale

We found out recently that if you try to leave a little kid in a graveyard late at night, he'll freak out. Even if you offer to leave him a weapon to protect himself. Why? It's because on some instinctual level, all humans know it's just a matter of time until the zombies show up. A Canadian mathematician believes only frequent coordinated attacks against the living dead can save the human race. A mathematical calculation by a professor at the University of Ottawa – $(bN)\left(\frac{S}{N}\right)z = bSZ$, describes the rate that humans would become zombies as they are gradually infected by the living dead.

The maths might seem bizarre, but it can be used to model the spread of disease in the modern world. In fact, the spread of zombification closely resembles the spread of infectious disease, a fear which is hardwired into our evolutionary response. Today, mathematical models are being increasingly used to understand the spread of infectious diseases and to evaluate the potential impact of control programmes.

In this course, we are going to construct mathematical models to explore the dynamics of a contagious disease as it moves through a population. You will also be introduced to computer simulations which is frequently used to predict patterns of disease spread and evaluate the impact of vaccination / control strategies.



Nature Reviews | Microbiology

Mark Scheme Table

	Skills	1st (70-100)	2:1 (60-69)	2:2 (50-59)
Subject knowledge	Knowledge and Understanding	o All content included is relevant to the general topic and to the specific question/title o Good understanding of all the relevant topics. o Scientific terms are defined and used accurately throughout o Clear justification on how the content included is related to the specific issues that are the focus of the assignment	o Most of the content included is relevant to the general topic and to the specific question/title o Good understanding of most the relevant topics o Scientific terms are used accurately but not always clearly defined. o Adequate justification on how the content included is related to the specific issues that are the focus of the assignment	o Some of the content included is relevant to the general topic and to the specific question/title o Good understanding on some of the relevant topics but occasional confusion on others. o Scientific terms are used mostly accurately with occasional confusion and often not defined. o Some justification on how the content included is related to the specific issues that are the focus of the assignment
Critical thinking	Research and Evidence	o Inclusion of rich sources of research findings, data, quotations or other sourced material as evidence for the claims/ ideas o Use evidence/calculations to support claims/assertions /ideas, consistently clearly and convincingly o Data is effectively analysed and appropriate assumptions/conclusions are reached	o Inclusion of adequate sources of research findings, data, quotations or other sourced material as evidence for the claims/ ideas o Use evidence/calculations to support claims/assertions/ideas, mostly clearly and convincingly o Data is analysed and the assumptions/conclusions that are reached are mostly appropriate	o Inclusion of some sources of research findings, data, quotations or other sourced material as evidence for the claims/ ideas o Use evidence/calculations to support claims/assertions/ideas, at times clearly and convincingly o There is an attempt to analyse data is and draw assumptions/conclusions
	Developing an Argument	o Argument/proof exceptionally well-developed and well-justified o Uses concepts from the tutorials in an unfamiliar context, and does so accurately and	o Argument/proof clear and well-developed and position justified o Use some concepts from the tutorials in an unfamiliar context, but not always accurate	o Argument/proof clear but not well-developed o Limited use of concepts from the tutorials in other contexts o Some analysis of content to support

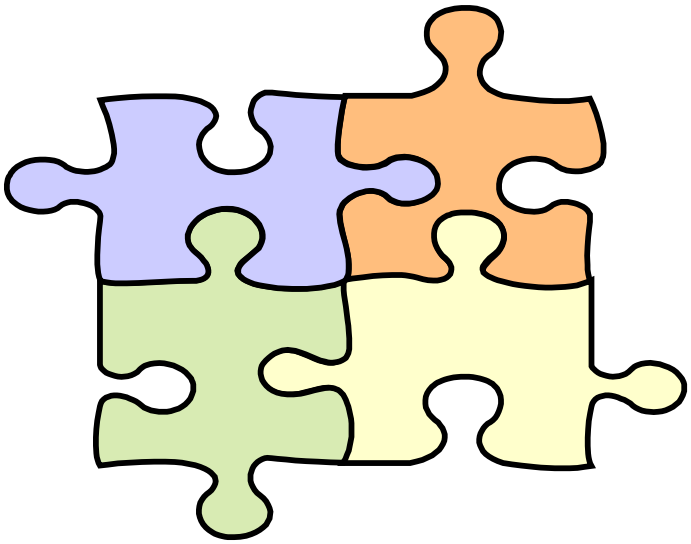
		confidently o Content is analysed effectively to support the argument	o Analysis of content to support the argument	the argument
	Critical Evaluation	o Moved beyond description to an assessment of the value or significance of what is described o Evaluative points are consistently explicit/systematic/reasoned/justified o Effective critiques on the reliability of sources provided	o Mostly description but some assessment of the value or significance of what is described o Evaluative points are mostly explicit/systematic/reasoned/justified o Some evidence of critiques on the reliability of sources provided	o Only description with minimal assessment of the value or significance of what is described o Evaluative points are at times explicit/systematic/reasoned/justified o Limited evidence of critiques on the reliability of sources provided
Written communication	Structure and Presentation	o Ideas are presented in paragraphs and arranged in a logical structure that is appropriate for the assignment o All calculations, formulas and methods are clearly structured, clear to follow and correct o Tables and graphs are effectively constructed including appropriate headings, units and scales.	o Ideas are presented in paragraphs and arranged in a structure that is mostly appropriate for the assignment o Calculations, formulas and methods are mostly structured, clear to follow and correct o Most tables and graphs are well constructed	o Ideas are presented in paragraphs and arranged in a structure o Calculations, formulas and methods are not always structured, clear to follow and correct. o Some tables and graphs are well constructed but contains some errors
	Language and Style	o No spelling, grammar or punctuation errors o Units and significant figures are presented accurately throughout o Writing style consistently clear, appropriate for scientific documents and easy to follow o Accurate and consistent use of technical language and vocabulary	o Minimal spelling, grammar or punctuation errors o Units and significant figures are presented accurately throughout o Writing style mostly clear, appropriate for scientific documents and easy to follow o Some attempts of using technical language and vocab alary, but not always accurate	o Some spelling, grammar or punctuation errors o Units and significant figures are presented accurately throughout with occasional errors o Writing style moderately clear, appropriate for scientific documents and easy to follow o Use of simple language and vocabulary effectively but struggles to use technical language

Glossary of Keywords

Fill this out as we go through the course. If you are unclear about a term or a concept, write it down here and we'll

Word	Definition	In a sentence

Tutorial 1 – Infectious disease vs non-infectious disease



Tutorial 1 objectives

- Overview of the course structure.
- Understand the concept of infectious diseases.
- Understand and know the contrast between infectious and non-infectious diseases.
- Understand the definition of epidemic diseases.
- Understand the definition of endemic / pandemic diseases.

Activity 1.1 – Definition of infectious and non-infectious diseases

Infectious diseases are caused by **pathogenic microorganisms**, such as bacteria, viruses. parasites or fungi; the diseases can be spread, directly or indirectly from one person to another.

Method of transmission include:

Non-infectious diseases (also called Non-communicable diseases) are those diseases that are not caused by a pathogen and cannot be shared from one person to another.

Non-infectious diseases may be caused by:

Unlike infectious disease, non-infectious diseases are not communicable or contagious, although some kinds can be passed down genetically to the children of a carrier.

Activity 1.2 – The spread of infectious diseases: endemic, epidemic and pandemic

Epidemiology is the _____ of the _____ and _____ of _____ or events in _____, and the _____ of this study to the control of health problems.

What do we mean when we say a disease is epidemic?

In epidemiologic terms, _____ refers to an increase, often sudden, in the number of cases of a disease above what is normally expected in that population in that area. _____ carries the same definition of epidemic, but is often used for a more limited geographic area. A classic example of an epidemic disease would be the 2003 Severe Acute Respiratory Syndrome (SARS). The epidemic killed about _____ people out of the _____ that were infected. It started as an outbreak in Asia and then spread to two dozen countries and took the form of an epidemic.

More than 8,000 people have died from _____ in West Africa since February 2014 and it has spread beyond the three countries initially affected. So, is Ebola an _____ or is it an _____?

Notes

Pandemic

A _____ on the other hand refers to a worldwide (global) epidemic, – one that has spread over several countries or continents affecting a large number of people. It could have started off as outbreak, escalated to the level of an epidemic and eventually spread to a number of counties across continents. The 2009 flu pandemic is a good example. Between the period of _____ and _____, there were approximately _____ deaths in over _____ countries. The flu virus (H1N1) probably originated in Mexico and within two months, sustained human-to-human transmission in several countries on different continents was reported, prompting the WHO to announce the highest alert level (phase 6, pandemic) on June 12, 2009.

What is the difference between epidemic and endemic disease?

Some diseases can remain active in a given area for years and years. A disease is described as _____ when it is _____ (constant presence) present within a given geographic area or a certain population. For example, one of the most talked about endemic diseases is malaria. The WHO estimate that around half of the world's population live in areas where they are at risk of Malaria infection. It is endemic in large parts of Africa as well as some areas of South America. Under certain circumstances, an epidemic can lead to a disease becoming endemic. For example, bovine Tuberculosis (bTB) in the UK.

Endemic diseases are not always present at high levels. They can be relatively rare. The defining feature of a regional endemic disease is that is can always be found in population that lives there.

Dengue fever, which is spread by mosquitoes, is considered an endemic disease in more than 100 countries. So why isn't dengue considered a pandemic yet?

Why Bother?

Although people use terms like outbreak and epidemic interchangeably, it would only be fair to understand the definitive meaning behind each word. An outbreak can take the form of an epidemic and eventually a pandemic, but that does not entitle us to use these words incorrectly.

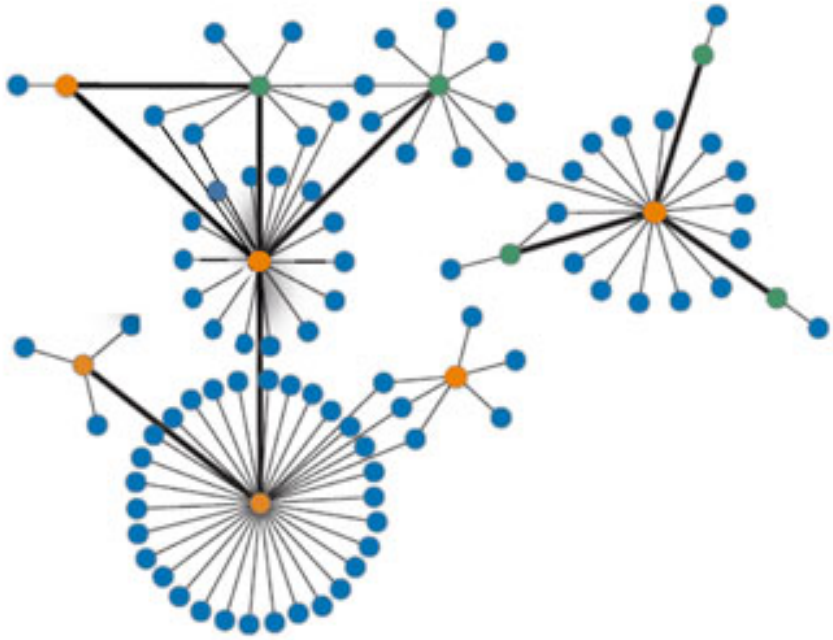
Homework 1

1) For the list of diseases below, find out whether they are infectious or non-infectious disease based on the definition given in the tutorial. Give justifications by briefly describe their characteristics (e.g. what is the cause of the disease, and how it is spread).

Ebola
Chickenpox
Common cold
Tuberculosis
Hepatitis A
HIV/AIDS
Athlete's foot
Mosquito bites or Tick born diseases
Cancer
Cardiovascular diseases such as heart disease
Diabetes

2) For all infectious diseases you have identified above, state if they are an epidemic, endemic or pandemic disease. Find out the average mortality rate.

Tutorial 2 – Introduction to mathematical models



Tutorial 2 objectives

- How mathematical modelling can be used to understand the spread of infectious diseases.
- To develop the SIR model for the spread of an infectious disease, including the concept of transition parameter.
- Introduce the concept of the reproductive ratio (R0), and how it is used as a measure of disease spread.

Activity 2.1 – Terminology

Model:

A mathematical model is a set of assumptions expressed as a set of equations. The equation themselves are expressed in terms of

Example

A practical example to go through with student on the board (book work)

Notation:

- State variable is often denoted using a single capital letter, e.g. S, R, X or N. N is often used to represent the population abundance.
- The state variable can be a scalar (a single number) or a vector of values.
- Model parameters are often denoted using a Greek (lower case) letter, e.g. α, β, θ
- The notation for the particular point (or interval) in time differs between discrete time models and continuous time models: N_t for discrete time and N(t) for continuous time.

Activity 2.2 - Deterministic vs Stochastic Models

Deterministic Models:

With a deterministic model: Given N_t and θ, N_{t+}, where t+ > t, is known exactly.
In other words, there is no randomness in the evolution of the state.

Example: Every year every animal gives birth to 3 new animals, then the "parents" always die.
Suppose at time t=1 there are N_1=10 animals, then at time t=2:

$$N_2 = N_1 + \text{births} - \text{deaths} = N_1 + N_1 * 3 - N_1 = 10 + 10 * 3 - 10 = 30$$

Comments: This model can be written more generically using parameters for birth and death "rates":

$$\Theta = (\alpha, \beta): \quad N_{t+1} = N_t + \alpha N_t - \beta N_t$$
$$= N_t + (\alpha - \beta)N_t$$

where in the above example, $\alpha = 3$, $\beta = 1$.

Stochastic Models:

With a stochastic model: The future is not totally predictable, i.e. there is some random element.
These models are often expressed in terms of probabilities of something happening. You get different answers each time you run the model, even with the same parameter values and initial conditions.

Example: Suppose there are initially $N_1 = 10$ animals. Every year every animal gives birth to 2 new animal with probability 0.5 and 3 new animals with probability 0.5, i.e.,

$$\Pr(\alpha_i = 2) = \Pr(\alpha_i = 3) = 0.5,\ i = 1,\ldots,10$$

Following birth, the parents die with probability 0.5, i.e.,

$$\Pr(\beta_i = 1) = \Pr(\beta_i = 0) = 0.5,\ i = 1,\ldots,10.$$

Computer simulation example of a stochastic birth process.

Notes

Activity 2.3 - Discrete vs Continuous Time Models

Time is always a variable in ecological dynamics. As seen previously the state variable, however chosen, is always a function of time.

The essential mathematical distinction between **discrete** and **continuous** time models is how the domain of time is defined, i.e., how the time index t is defined:

- For discrete models: t is a discrete variable, often with evenly spaced values: t = 0,1,2,..., or irregularly spaced t = 0, 1/2, 3/4, 1, 3/2, 7/4, and so on.
- For continuous models: The domain of t includes an interval, e.g., $t \in [0, T]$, where $T > 0$.

Discrete Models:

A discrete model is formulated in discrete time steps.
The future state of the system is described in terms of the current state using an **update** rule:

$$N_{t+\Delta t} = F(N_t, t, \theta)$$

where θ represents the parameters in the model. Often $\Delta t = 1$. Using the previous simple example

$$N_{t+1} = F(N_t, t, \theta = (\alpha, \beta)) = N_t + (\alpha - \beta)N_t$$

Update rules for Discrete models are also called _____. Referring to the above equation, the difference between time periods:

$$N_{t+1} - N_t = (\alpha - \beta)N_t$$

Continuous Models:

A continuous model is formulated in continuous time. In contrast to discrete model formulation where future states are written as functions of past states, continuous models are often formulated in terms of the current rate of change of the state variable, i.e., by _____.

$$\frac{dN}{dt} = F(N, t, \theta)$$

An example known as the exponential model:

$$\frac{dN}{dt} = rN(t)$$

Note: if the differential equation is "solved", namely integrated with respect to time to yield a function N(t) such that $\frac{dN}{dt} = F(N, t, \theta)$, then one can (usually?) write down an update rule for the continuous model. For example,

$$\frac{dN}{dt} = rN(t)$$

when solved (integrated with respect to t) yields

$$N(t + \Delta t) = N(t) \exp(r\Delta t)$$

Activity 2.4 – Balance equations

All changes in a model of a system can only occur as a result of one of the processes in the model (birth, death, migration). Mathematical expressions for the changes are _____ or _____.

- In discrete time models, they are expressed in terms of the current and future state of the system. Note: this is really no different than the update rule.
- In continuous models, they are expressed in terms of the rate of change of the state of the system. Note: this is often the way the model is defined.

Examples:

Discrete time population model:

in future = # now + # born - # died + # immigrated - # emigrated

Continuous time population model:

rate of change of population = birth rate - death rate + immigration rate - emigration rate

So, balance equations for discrete time models involve numbers while those for continuous models involve rates.

Activity 2.5 - Steps in Model Formulation

Homework 2

Introduction to R programming (homework sheet)

The purpose of this course is to provide hands-on experience using computer software to simulate disease transmission dynamics, to graphically examine dynamic phenomena, and to verify theoretical results empirically. R will be used throughout the course, and also form an essential part of your final assignment.

Tutorial 3 – Models of disease

$$\frac{dS}{dt} = -\beta SI$$
$$\frac{dI}{dt} = \beta SI - \delta I$$
$$\frac{dR}{dt} = \delta I$$

Tutorial 3 objectives

- How mathematical modelling can be used to understand the spread of infectious diseases.
- To develop the SIR model for the spread of an infectious disease.
- Introduce the concept of the reproductive ratio (R_0), and how it is used as a measure of disease spread.

Activity 3.1 – terminology

We can construct mathematical models to explore the dynamics of a contagious disease as it moves through a population, for example the near annihilation of the British rabbit population by the introduction of myxomatosis from South America. Diseases are not simple binary (on/off; yes/no) phenomena in populations. A member of a population may pass through a sequence of stages during the course of the disease, and to effectively model the disease dynamics as it moves through a population, we must come to terms with the various phases.

Different diseases affect individual animals differently, and consequently, may have differing number of stages; this leads to a variety of different types of models for understanding the dynamics of epidemics. Things we would like to know when confronting the spread of disease:

Although there are different phases associated with many diseases; there will be some commonality across diseases, so we will start with some common terminology.

_____ - Individual who has not yet been infected, capable of contracting the disease, S

_____ - Time between exposure and time individual become infectious

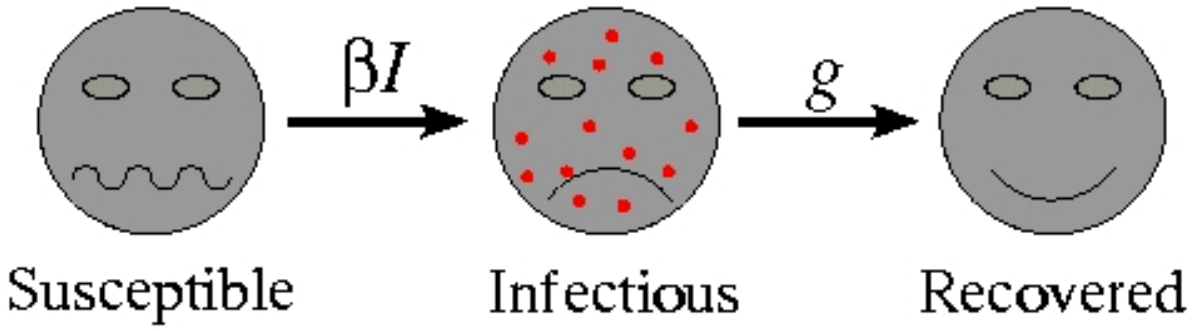
_____- Time during which individual can pass disease to susceptible

_____- Time from infection to appearance of symptoms

_____ - Can pass disease to others, I

_____ - Individuals no longer exposed to infection; either because of immunity or death, R

Thus, the entire population is assumed to be fixed size and is comprised of individuals of three types:



Movement rates between classes of the SIR model

Activity 3.2 – The SIR model

We wish to model the rate of change of the size of the pool of individuals in each of the three states in our population; using these assumptions:

1. Susceptibles become infectives at a rate proportional to the number of susceptiles and infectives; βSI where β is defined as the infection rate

2. Infectives move on to the removal class at a rate proportional to their numbers γI (note γ is referred to as either a removal rate or a recovery rate, depending on your degree of optimism)

Kermack and McKendrick (1927) worked out the basic formulation of a model for the dynamics of epidemics

$$\frac{dS}{dt} = -\beta SI$$
$$\frac{dI}{dt} = \beta SI - \delta I$$
$$\frac{dR}{dt} = \delta I$$

Activity 3.3 – Conditions for an epidemic

If we think about the growth rate of the disease, we can consider whether it is spreading or receding. If the 'reproduction' rate of the disease exceeds 1, the disease is spreading; if it is below 1, it will peter out.

How to measure the 'reproductive' rate of a disease? By measuring the number of individuals infected by contact with a single infected individual before that individual's recovery. Under what conditions is the rate of change of infectives positive?

$$\frac{dI}{dt} > 0 \Rightarrow \beta SI - \gamma I > 0$$

This places a condition on the relationship between S, γ, and β. The quantity γ/β is defined as the _____, and is the ratio of the removal rate to the infection rate. Our concept for 'reproductive' rate is defined in terms of the relative removal rate. The length of the infectious period was defined as the reciprocal of the removal rate (1/γ). For each unit of time while infectious, an individual infects βS other individuals; then over the course of the period during which they are infectious, they will spread the disease to

$$\beta S \frac{1}{\gamma}$$

individuals. This term is defined as the reproductive rate, denoted as R0, and it is R0 exceeds which constitutes the threshold condition for the spread of an epidemic.

$$R_0 = \frac{\beta S_0}{\gamma} > 1$$

then an epidemic will occur. S_0 here is the number of susceptibles at the time an infected individual is introduced to the population.

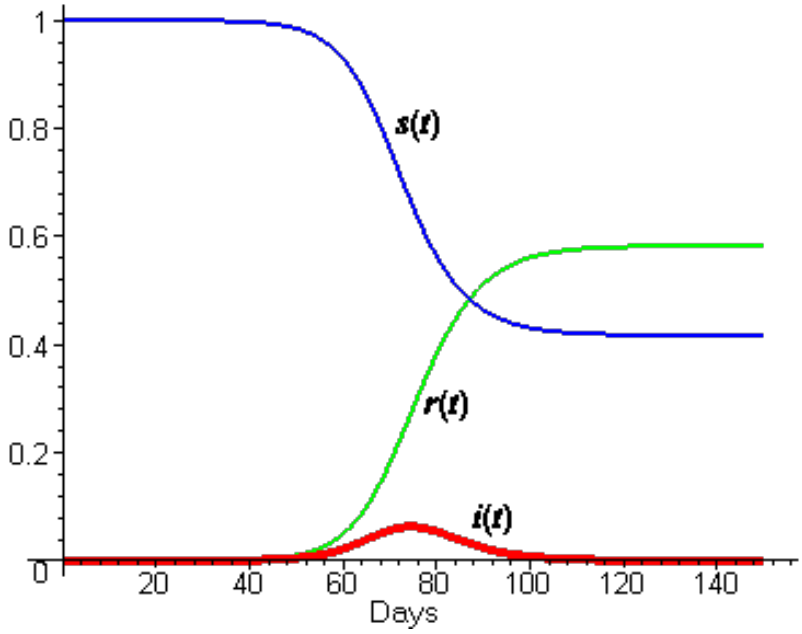
Example of the spread of an epidemic and how to use computer simulations to demonstrate the virulence of an epidemic.

Notes

Homework 3 (homework sheet)

Exercises: Use computer simulations to solve for R_0

Tutorial 4 – Models of disease II



Tutorial 4 objectives

- Introduce different models to describe more complex dynamics in disease transmission
- Appreciate the complexity in mathematical modelling of diseases
- Aware of the simplifying model assumptions and shortfalls of models to predict disease spread

Activity 4.1 – A more sophisticated disease model

Let's add a new phase to the disease, a period during which the individuals have been exposed but are not yet infectious. This was the latency period defined earlier. The purpose for this addition is to mimic behaviour of diseases such as measles. Our compartment model now contains an additional compartment, E those exposed, but not yet infected.
Our differential equations describing the passage of individuals between compartments now become:

$$\frac{dS}{dt} = -\lambda S(t)$$
$$\frac{dE}{dt} = \lambda S(t) - fE(t)$$
$$\frac{dI}{dt} = fE(t) - rI(t)$$
$$\frac{dR}{dt} = rI(t)$$

where

S – number of susceptible individuals
E – number of exposed individuals
I – number of infectious individuals
R – number of recovered individuals
λ – rate of infection per unit time
f – rate at which an infected individuals becomes infectious (reciprocal of latency period)
r – rate at which infectious person recovers (reciprocal of infectious period, denoted as D below)

Here the parameter **λ** for infection rate is measured differently that previously described in the SIR model. **λ** is defined as the fraction of the population contacted per unit time by infected individuals. Hence **λ** carries within it the number of infected in the population at any time I(t). In addition, we will use an observable reproduction number (unfortunately called R) to denote the observed number of susceptibles contacted during their infectious period. From this, we can back-track our way to a definition of **λ** as

$$\lambda = \frac{\frac{R}{D}}{N}$$

Examine how changing the number of contacts by an infected individual changes the shape (as well as the timing) of the number of infected (play around with the R code provided and explore the plotting function).

Activity 4.2 – And what about demographic processes?

Add yet further complexity (realism) to our model by affording the opportunity for individuals in any of our compartments (S-E-I-R) to die, and for there to be recruitment of new individuals to the Susceptible compartment:

Schematic diagram of the compartment and dynamics

Our differential equations describing the passage of individuals between compartments now become:

$$\frac{dS}{dt} = -\lambda S(t) + bN - mS(t)$$
$$\frac{dE}{dt} = \lambda S(t) - fE(t) - mE(t)$$

$$\frac{dI}{dt} = fE(t) - rI(t) - mI(t)$$

$$\frac{dR}{dt} = rI(t) - mR(t)$$

Definition of new parameters:

- N – Total population size (all participate in recruitment process)
- B – Birth rate (per capita recruitment per time step (day))
- m – Death rate (1/life expectancy in days)

With our more complex model, we can examine the more long-term behaviour of a disease such as measles that occur in animal populations. In particular, we can observe potential patterns of resurgence of the disease.

From the model formulation above, how can there be a reappearance of the disease, in contrast to the behaviour of our previous SIR and SEIR models?

Furthermore, the potential exists to examine efficacy of mitigation strategies, such as vaccination programmes.

Link to exercises set on computer based work.

Homework 4 (homework sheet)

Exercises: Computer based exercises

Tutorial 5 – R programming tutorial

Tutorial 5 objectives

- Understand how to use computer simulations to predict / simulate disease spread.
- Familiar with the use of graphical representation to the SIR model.
- Use computer simulations to solve a system of ODE

This tutorial is largely based on computer practical of using R to construct epidemiological models and solve systems of ODE. Main focus is on the use of iterations and graphical output.

Final assignment (computer based work)

Given the disease scenario (with the initial conditions on all relevant model parameters), construct a SIR model of the zombification (i.e. spread of the zombie virus) in R.

Can the humans and Zombies coexist?

How fast does the zombie population needs to be extinguished in order to save the human race?

[Word count 3000]

Tutorial 6 – Feedback tutorial

Tutorial 6 objectives

- To receive feedback on final assignments.
- To share examples of best practice with the other pupils in your group.
- To write targets for improvement in school lessons.
- To reflect on the programme including what was enjoyed and what was challenging.

Final assignment feedback

What I did well…	What I could have improved on…
•	•
•	•
•	•

My target for future work is…

Reflecting on Uni Pathways

What did you most enjoy about Uni Pathways?
• • •

What did you find challenging about the programme?	How did you overcome these challenges?
• • •	• • •

Appendix 1 – Referencing correctly

When you get to university, you will need to include references in the assignments that you write, so we would like you to start getting into the habit of referencing in your Brilliant Club assignment. This is really important, because it will help you to avoid plagiarism. Plagiarism is when you take someone else's work or ideas and pass them off as your own. Whether plagiarism is deliberate or accidental, the consequences can be severe. In order to avoid losing marks in your final assignment, or even failing, you must be careful to reference your sources correctly.

What is a reference?

A reference is just a note in your assignment which says if you have referred to or been influenced by another source such as book, website or article. For example, if you use the internet to research a particular subject, and you want to include a specific piece of information from this website, you will need to reference it.

Why should I reference?

Referencing is important in your work for the following reasons:

- It gives credit to the authors of any sources you have referred to or been influenced by.
- It supports the arguments you make in your assignments.
- It demonstrates the variety of sources you have used.
- It helps to prevent you losing marks, or failing, due to plagiarism.

When should I use a reference?

You should use a reference when you:

- Quote directly from another source.
- Summarise or rephrase another piece of work.
- Include a specific statistic or fact from a source.

How do I reference?

There are a number of different ways of referencing, and these often vary depending on what subject you are studying. The most important to thing is to be consistent. This means that you need to stick to the same system throughout your whole assignment. Here is a basic system of referencing that you can use, which consists of the following two parts:

1. **A marker in your assignment**: After you have used a reference in your assignment (you have read something and included it in your work as a quote, or re-written it your own words) you should mark this is in your text with a number, e.g. [1]. The next time you use a reference you should use the next number, e.g. [2].

2. **Bibliography**: This is just a list of the references you have used in your assignment. In the bibliography, you list your references by the numbers you have used, and include as much information as you have about the reference. The list below gives what should be included for different sources.

    a. **Websites** – Author (if possible), title of the web page, website address, [date you accessed it, in square brackets].

    E.g. Dan Snow, 'How did so many soldiers survive the trenches?', http://www.bbc.co.uk/guides/z3kgjxs#zg2dtfr [11 July 2014].

    b. **Books** – Author, date published, title of book (in italics), pages where the information came from.

    E.g. S. Dubner and S. Levitt, (2006) *Freakonomics*, 7-9.

    c. **Articles** – Author, 'title of the article' (with quotation marks), *where the article comes from* (newspaper, journal etc.), date of the article.

    E.g. Maev Kennedy, 'The lights to go out across the UK to mark First World War's centenary', Guardian, 10 July 2014.

Appendix 2 – Using the VLE

VLE username	
VLE password	

Please remember the following key details...

- You are able log into the VLE either through the link on our website (www.thebrilliantclub.org) or going directly to the VLE site at (https://portal.thebrilliantclub.org/sign-in).
- Please update your profile with your full name and email address- this will allow you to retrieve forgotten passwords or usernames
- If you forget your log-in details you can request them to be emailed to you by clicking the link on the VLE home page. (If you are still having problems you can email: schools@thebrilliantclub.org)

What is the VLE?

The VLE is a virtual learning environment for all pupils on Uni Pathways it is used for:

- messaging your tutor
- submitting homework
- submitting your final assignment
- accessing resources for your tutorials
- finding out more information about university and careers

How should I use the VLE?

The VLE is a professional academic environment in which pupils are able to message their PhD Tutor. Here are a few things to consider:

- Ensure you keep a professional tone in the messages you send to your tutors.
- Ensure you always reply to your tutors in a timely manner.
- Thank your tutor for the effort they are putting in to give you your feedback etc.
- Submit all homework to your tutor on time.

IMPORTANT: Final assignment

- When you submit your final assignment, please remember that you need to do so through the 'My Activities' tab and not as an attachment to a message.

Notes

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Only maths can Save you from the Zombie apocalypse

Key Stage 4 Programme

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