Module	Key Term	Definition	Topic
P1	models	simplified way to explain a complex situation	Models
P1	simplifications of a model	reduce number of variables / parameters involved	Models
P1	assumptions of a model	assume that a real life situation follows a similar pattern to statistical model	Models
P1	refining a model	compare real life data with predictions from the statistical model, then change the model to improve the fit	Models
P1	problem solving cycle	define problem, collect data, analyse with calculations & graphs, conclusion, refine & repeat	Models
S1	population	whole group of every single thing	1 Sampling
S1	finite population	a population for which it is possible and practical to count its members.	1 Sampling
S1	infinite population	a population for which it is impossible or impractical to count its members.	1 Sampling
S1	survey	method of collecting information from a population, quicker & cheaper than a census	1 Sampling
S1	census	survey in which information is collected from every single member of population, time consuming and expensive method, quite accurate	1 Sampling
S1	sample	selection from a population	1 Sampling
S1	sampling frame	full list of all sampling units	1 Sampling
S1	systematic sampling	selection of every 'nth' member from a list of population, e.g. select every 10^{th} person from a list of 1000 in alphabetical order	1 Sampling
S1	stratified sampling	proportional selection from categories of a population, random selection from each category	1 Sampling
S1	quota sampling	fixed selection from categories of a population, NOT random selection from each category	1 Sampling
S1	opportunity sampling	selection from a population convenient to the sampler	1 Sampling
S1	statistic	quantity that is calculated using only known observations from a sample	1 Sampling
S1	variability	spread or dispersion of results around mean or expected value – see variance	1 Sampling
S1	simple random sampling	each member is equally likely to be chosen, number every member of population, select using random number table, each selection is independent	2 Data
S1	data	measurements, values associated with a variable	2 Data

S1	large data set	big file of measurements that requires groupings or categories in order to analyse, too big for normal computer	2 Data
S1	observation	scientific measurement	2 Data
S1	variable	something that changes, represented by a letter	2 Data
S1	qualitative variable	variable that takes non-numerical values	2 Data
S1	quantitative variable	variable that takes numerical values	2 Data
S1	discrete variable	categories or groups with gaps, for example hair colour, dog breeds	2 Data
S1	continuous variable	infinite range of values, for example human height or weight	2 Data
S1	frequency table	table for discrete data, columns for data value, frequency, etc. Calculate mean, variance, etc.	2 Data
S1	grouped frequency table	table for grouped data, columns for class (group), mid-point of class, frequency, etc. Calculate group mean, variance, frequency density, etc.	2 Data
S1	class	group or range of data values, e.g. length x in cm, $5 \leq x < 10$	2 Data
S1	class boundary	maximum or minimum value of the group (class), often shown as inequality, discrete data classes have gaps, continuous have no gaps	2 Data
S1	Lower class boundary	minimum value of the group (class)	2 Data
S1	Upper class boundary	maximum value of the group (class)	2 Data
S1	class width	upper class boundary – lower class boundary	2 Data
S1	mid-point of class	(lower class boundary + upper class boundary) / 2	2 Data
S1	frequency polygon	graph plotting frequency against mid-point of class, straight lines between plot points (not curve)	2 Data
S1	histogram	diagram like a bar chart, showing frequencies of variables in classes (frequency α area of bar), no gaps	2 Data
S1	frequency density	the frequency of a class divided by its class width	2 Data
S1	frequency in a histogram	proportional to the area of a bar	2 Data
S1	location	measure of where 'centre' of data lies (average)	3 Location
S1	mean	measure of location - sum of a set of data values divided by the number, good as uses all data, not good if data skewed	3 Location

S1	median	measure of location - value in middle when data values are in size order, good if outliers or skewed data	3 Location
S1	mode	measure of location – most frequently occurring value, good for qualitative data, not good if more than one mode	3 Location
S1	position of variable	placing of a variable when data in size order, e.g. 12^{th} place from smallest	3 Location
S1	value of variable	size of a variable, e.g. 12^{th} place variable has a value of 23 cm	3 Location
S1	mean – grouped data	$\bar{x} = \Sigma fx / \Sigma f$, mean = sum of (frequency x mid-point) / sum of frequency, this is an estimate	3 Location
S1	median – grouped data	Use n/2 to find the position of the median, which class the median is in, use linear interpolation to estimate the value of the median	3 Location
S1	linear interpolation	used to estimate value of a variable position, knowing class boundaries, using ratios, $(m - lcb) / (ucb - lcb) = (f_m - f_{lcb}) / f_{ucb} - f_{lcb})$, see example….	3 Location
S1	modal class - grouped data	class with highest frequency density	3 Location
S1	combined means	$\bar{x}_{combined} = (n_1 \bar{x}_1 + n_2 \bar{x}_2) / (n_1 + n_2)$	3 Location
S1	skewness	a measure of how symmetrically distributed a set of data is, this term not used in current A' level	3 Location
S1	coding	change data values to ones that are easier to work with, $y = (x - a) / b$, often a = modal class mid-point, b = smallest class width, not in current A level	3 Location
S1	dispersion	how spread out data values are	4 Dispersion
S1	range	measure of dispersion - the difference between highest & lowest values, affected by extreme data values	4 Dispersion
S1	interquartile range	measure of dispersion - the difference between the upper and lower quartile, not affected by extreme values	4 Dispersion
S1	quartiles	dividing an ordered data set into 4	4 Dispersion
S1	lower quartile (Q_1)	value that 25% of data values in a data set are less than or equal to	4 Dispersion
S1	median (Q_2)	value that 50% of data values in a data set are less than or equal to	4 Dispersion
S1	upper quartile (Q_3)	value that 75% of data values in a data set are less than or equal to	4 Dispersion
S1	percentiles	dividing an ordered data set into 100 parts	4 Dispersion
S1	interpercentile range	measure of dispersion – the difference between the values of two stated percentiles	4 Dispersion

S1	cumulative frequency diagram	graph of cumulative frequency against upper class boundary	4 Dispersion
S1	cumulative frequency	sum of a class frequency and all preceding frequencies, a ‘running total’	4 Dispersion
S1	boxplot	diagram showing the median, quartiles, extremes and outliers for a data set	4 Dispersion
S1	outlier	freak piece of data lying a long way from most of the others (= anomaly)	4 Dispersion
S1	fence	boundary, beyond which data is classed as an outlier, shown on box plot	4 Dispersion
S1	lower fence	smallest fence value, Q1 – (1.5 x IQR)	4 Dispersion
S1	upper fence	largest fence value, Q3 + (1.5 x IQR)	4 Dispersion
S1	variance	measure of dispersion from mean, variance $\sigma^2 = (\Sigma\ f x^2 / \Sigma\ f x^2) - (\Sigma\ f x / \Sigma\ f x)^2$, mean of the squares minus square of the means, affected by outliers and extreme data	4 Dispersion
S1	standard deviation	measure of dispersion, square root of variance, affected by extreme data values, same units as data, written σ	4 Dispersion
S1	outlier	more than 3 standard deviations from the mean, commonly calculated as outside the limits $\pm$ (1.5 x IQR) from median	4 Dispersion
S1	coding	transforming the numbers of a data set to make them easier to work with, $y = (x – a) / b, \Rightarrow \bar{y} = (\bar{x} – a) / b, \Rightarrow \sigma_y = \sigma_x / b$, ‘a’ does not affect σ, does affect mean	4 Dispersion
S1	bivariate data	data which comes as an ordered pair of variables, e.g. (x,y)	5 Correlation
S1	scatter diagram	graph showing the two variables in a bivariate data set	5 Correlation
S1	cluster	number of data values close together	5 Correlation
S1	correlation	linear relationship between 2 variables (a link that may not be causal)	5 Correlation
S1	explanatory variable	variable you can control (= independent variable)	5 Correlation
S1	response variable	what you measure in an experiment (= dependent variable)	5 Correlation
S1	linear regression	method to find equation of a line of best fit on a scatter diagram	5 Correlation
S1	regression line	line of best fit found using the linear regression method	5 Correlation
S1	interpolation	prediction within range for which you have data	5 Correlation
S1	extrapolation	prediction outside range for which you have data	5 Correlation
S1	trial	process with different possible outcomes, e.g. an experiment	6 Probability
S1	outcome	one of the possible results of a trial or experiment	6 Probability
S1	event	group of possible outcomes	6 Probability

S1	sample space	set of all possible outcomes of a trial or experiment	6 Probability
S1	Venn diagram	shows how a collection of events relate to the outcomes	6 Probability
S1	addition law	formula: $P(A \cup B) = P(A) + P(B) – P(A \cap B)$	6 Probability
S1	complement (of an event A)	group of outcomes corresponding to event A not happening	6 Probability
S1	product law for independent events	$P(A \cap B) = P(A)\ P(B)$, if the probability of A does not depend on event B	6 Probability
S1	intersection	set of outcomes where both events A and B happen, $P(A \cap B)$	6 Probability
S1	union	set of events where either events A or B or both happen, $P(A \cup B)$	6 Probability
S1	mutually exclusive	$P(A \cup B) = P(A) + P(B)$, no outcomes in common - they cannot happen at the same time	6 Probability
S1	two-way table	sample space table showing all posible events in cells,	6 Probability
S1	tree diagrams	show probabilities for sequences of two or more events, simple example…	6 Probability
S1	variable	quantity that changes	7 Probability distributions
S1	random variable	variable taking different values with different probabilities	7 Probability distributions
S1	discrete random variable	random variable (X) with 'gaps' between its possible values, $\sum P(X=x) = 1$	7 Probability distributions
S1	continuous random variable	random variable (X) measured on a continuous scale - with no 'gaps'	7 Probability distributions
S1	probability function	shows probabilities of a variable taking a particular value, example table…	7 Probability distributions
S1	discrete uniform distribution	where all possible values are equally likely	7 Probability distributions
S1	normal distribution	continuous 'bell-shaped' probability distribution	7 Probability distributions
S1	sample space diagram	shows all possible outcomes of a trial or experiment, example…	7 Probability distributions
S1	cumulative distribution function	function F(x), probability that a random variable is less than a value, $F(x) = \sum P(X \leq x)$, example table…	7 Probability distributions
S1	factorial function	$3! = 3 \times 2 \times 1 = 6$	7 Probability distributions

S1	combinatorial (choose) function	calculator function for combinations of r items from a group of n, ${}^{n}C_{r}$ = (n r) (matrix) = n! / (n – r)! r!	7 Probability distributions
S1	permutation function	${}^{n}P_{r}$, more than the number of combinations as the order of selection matters, not in current A' level	7 Probability distributions
S1	binomial coefficient	number of ways of choosing r items from a group of n items (${}^{n}C_{r}$)	7 Probability distributions
S1	binomial distribution	discrete probability distribution B, models number of successes x in n independent trials when constant probability of success is p, X~B(n,p)	7 Probability distributions
S1	binomial asumptions	fixed number of trials n, each trial either success or failure, independent trials, constant probability of success p	7 Probability distributions
S1	binomial probability function	$P(X = x) = {}^{n}C_{r}\, p^{x}\, (1 - p)^{n-x}$	7 Probability distributions
S1	binomial tables	used in older exam papers and text books, now replaced by calculator function, simple look-up tables of probabilities, $P(X \leq x)$, where X~B(n,p)	7 Probability distributions
S1	binomial PD button on calculator	binomial probability distribution, P(X = x), where X~B(n,p), see function formula	7 Probability distributions
S1	binomial CD button on calculator	binomial cumulative distribution, $P(X \leq x)$, where X~B(n,p), note all values less than x	7 Probability distributions
S1	binomial tables backwards	starting with a probability to find the associated value of 'x'	7 Probability distributions
S1	Expectation value	$E(X) = np = \mu$, mean, not in current A level	7 Probability distributions
S1	Variance	Var (X) = np (1 – p)	7 Probability distributions
S1	Inequality tables	greater than, no more than, at least, fewer than, at most	7 Probability distributions
S1	hypothesis test	method of testing a hypothesis using observed sample data	8 hypothesis
S1	hypothesis	statement of claim that you want to test	8 hypothesis
S1	alternative hypothesis	statement that you will accept instead if you choose to reject null hypothesis, gives a range of values, written H_1	8 hypothesis
S1	null hypothesis	statement that gives a specific value to the parameter in a hypothesis test, written H_o	8 hypothesis
S1	one-tailed test	when alternative hypothesis parameter is greater or less than value specified by null hypothesis, P(critical region) = significance level	8 hypothesis

S1	two-tailed test	when alternative hypothesis parameter is not equal to value specified by null hypothesis, P(critical region) = significance level / 2	8 hypothesis
S1	significance level (alpha)	determines how unlikely observed value of test statistic needs to be (under Ho) before rejecting null hypothesis	8 hypothesis
S1	significant result	if observed value of a test statistic is lower than significance level	8 hypothesis
S1	test statistic	calculated from a sample, used to decide whether or not to accept or reject null hypothesis	8 hypothesis
S1	actual significance level	in a hypothesis test, probability of rejecting the null hypothesis when it is true	8 hypothesis
S1	critical region	set of all values of test statistic to cause you to reject null hypothesis, also called tails	8 hypothesis
S1	acceptance region	set of all values of test statistic to cause you to accept null hypothesis, major area of distribution diagram	8 hypothesis
S2	correlation	a linear relationship between 2 variables (a link that may not be causal), see PMCC	1 Regression
S2	positive correlation	straight line link or pattern of data on graph, increasing, see PMCC	1 Regression
S2	negative corelation	straight line link or pattern of data on graph, decreasing, see PMCC	1 Regression
S2	no correlation	no pattern of data on graph, data randomly spread, see PMCC	1 Regression
S2	explanatory variable	variable you can control (= independent variable)	1 Regression
S2	response variable	what you measure in an experiment (= dependent variable)	1 Regression
S2	linear regression	method to find equation of a line of best fit on a scatter diagram	1 Regression
S2	regression line	line of best fit found using linear regression method, $\bar{y} = a + b\bar{x}$ (compare to y = mx + c)	1 Regression
S2	interpolation	prediction within range for which you have data, more reliable	1 Regression
S2	extrapolation	prediction outside range for which you have data, less reliable so need to be cautious	1 Regression
S2	coded data	transforming numbers of a data set to make them easier to work with, y = (x – a) / b, $\Rightarrow \bar{y} = (\bar{x} - a) / b$, $\Rightarrow \sigma_y = \sigma_x / b$	1 Regression
S2	log graphs	using logarithms to transform curved graphs into straight lines, log-log: log y = n log x+ log a <or> log-normal: log y = x (log b) + log k	1 Regression
S2	product moment correlation coefficient (PMCC or r)	measure of correlation between two variables, use statistical function on calculator, range -1 < r < +1, strong negative – none – strong positive, not affected by coding	2 PMCC

S2	PMCC hypothesis testing	tests if the two variables are correlated	2 PMCC
S2	PMCC test statistic	PMCC or 'r' calculated from sample data	2 PMCC
S2	PMCC parameter	p, PMCC of the population	2 PMCC
S2	PMCC null hypothesis (H_0)	H_0: p = 0	2 PMCC
S2	PMCC alternative hypothesis one-tailed test	H_1: p > 0 or p < 0	2 PMCC
S2	PMCC alternative hypothesis two-tailed test	H_1: $p \neq 0$	2 PMCC
S2	PMCC significance level (α)	how unlikely the data is before rejecting H_0, usually α = 0.1 (10%), α = 0.05 (5%), α = 0.01 (1%)	2 PMCC
S2	PMCC critical region	set of all values of r that cause H_0 to be rejected, see PMCC critical values tables	2 PMCC
S2	PMCC hypothesis test conclusion	"The result is / is not significant at this level. This data does / does not provide evidence at the _ % significance level to support the claim that <*repeat context in question*>."	2 PMCC
S2	conditional probability	depends on whether another event happens ("given"), $P(B \mid A) = P(A \cap B) \div P(A)$	3 probability
S2	product law	$P(A \cap B) = P(A)\ (B \mid A)$,	3 probability
S2	modelling assumptions	approximations and simplifications made when defining a model	3 probability
S2	Normal distribution	a continuous 'bell-shaped' probability distribution, $X \sim N(\mu, \sigma^2)$	4 Normal Distribution
S2	Normal distribution assumptions	symmetrical distribution, mean ~ median ~ mode,	4 Normal Distribution
S2	normal distribution characteristics	bell-shaped curve, peak at mean (μ) , symmetrical about mean, mean = median = mode	4 Normal Distribution
S2	standard normal distribution area	area below the standard curve is defined to be 1, hence normalised	4 Normal Distribution
S2	Normal cumulative distribution function	Cdf = $P(X < x) = P(X \leq x)$	4 Normal Distribution

S2	Standard normal cumulative distribution function	$\Phi(z) = P(Z < z) = P(Z \leq z)$	4 Normal Distribution
S2	variance	measure of dispersion from expected mean	4 Normal Distribution
S2	standard deviation	measure of dispersion, square root of variance, $\sigma = \sqrt{}$ variance	4 Normal Distribution
S2	points of inflection	68% of area within 1 standard deviation of mean, 95% within 2 σ, 99.7% within 3 σ, diagram…	4 Normal Distribution
S2	standard normal variable, Z	random variable with normal distribution, mean 0 and variance 1, $Z \sim N(0 , 1)$	4 Normal Distribution
S2	Z-tables	including standard cumulative distribution function $\Phi(z)$ and percentage points tables, also use calculator statistical function 'Normal CD'	4 Normal Distribution
S2	percentage points table	p = P (Z > z), useful for certain decimal values of probability (p = 0.5, 0.1, 0.05, …), gives z value for these probabilities	4 Normal Distribution
S2	inverse normal function	using tables in reverse or selecting 'Inverse Normal' on caluclator, knowing the probability, find associated value of x	4 Normal Distribution
S2	sketch drawing	essential, helpful to show $P(X > x) = 1 – P(X \leq x)$ and others	4 Normal Distribution
S2	coding conversion formula	$Z = (X – \mu) \div \sigma$	4 Normal Distribution
S2	Normal approximation to a binomial distribution	Under conditions that $p \approx ½$ and n is large, then $Y \sim (np, np(1 – p))$, and use a continuity correction	4 Normal Distribution
S2	continuity correction	for approximations from a discrete to continuous in order to include or exclude a value by adding or subtracting ½, see table…	4 Normal Distribution
S2	Population mean hypothesis testing	$\overline{X} \sim N(\mu , \sigma^2/n)$, $Z = (\overline{X} – \mu) / (\sigma /\sqrt{n})$, where $Z \sim N(0 , 1)$	4 Normal Distribution
S2	Population parameter	the mean μ of the population	4 Normal Distribution
S2	Population null hypothesis	H_0: $\mu = a$	4 Normal Distribution
S2	Population alternative hypothesis one-tailed test	H_1: $\mu > 0$ or $\mu < 0$	4 Normal Distribution

S2	Population alternative hypothesis two-tailed test	$H_1: \mu \neq 0$	4 Normal Distribution
S2	Population significance level	how unlikely the data is before rejecting H_0, usually $\alpha = 0.1$ (10%), $\alpha = 0.05$ (5%), $\alpha = 0.01$ (1%)	4 Normal Distribution
S2	Population sample mean	$\bar{x}$	4 Normal Distribution
S2	Population test statistic	$z = (\bar{x} - \mu) / (\sigma / \sqrt{n})$	4 Normal Distribution
S2	Population critical value	work out p-value, then FIND A BETTER WAY TO EXPLAIN THIS!!!	4 Normal Distribution
S2	Population critical region	the set of all values of z that cause H_0 to be rejected	4 Normal Distribution
S2	Population hypothesis test conclusion	"The results is / is not significant at this level. This data does / does not provide evidence at the _ % significance level to support the claim that <*repeat context in question*>."	4 Normal Distribution

Module	Key Term	Definition
D1	activity network	A network that shows the order of completion. Arcs and nodes.
D1	adjacency matrix	A number grid that shows number of links between pairs of vertices in a graph.
D1	algorithm	A set of instructions for solving a problem
D1	alternating path	a way of improving an initial matching
D1	arc	Line between two vertices in a graph. Also called an edge
D1	binary search	a searching algorithm used to find numbers in a ordered list
D1	bipartite graph	a graph with two sets of nodes, joined by arcs; arcs only join opposite set.
D1	breakthrough	reaching an unmatched node using the alternating path method
D1	bubble sort	Algorithm that sorts a list by systematically swapping terms.
D1	Chinese postman problem	another name for the 'route inspection' problem
D1	complete graph	A graph where every vertex has a direct connection to every other vertex.
D1	complete matching	a matching with the same number of arcs as there are nodes in the set.
D1	critical activity	Must be started as soon as possible or entire project delayed (zero float).
D1	critical path	A set of critical activities from source node to sink node.
D1	cycle	a closed path through a graph that brings you back to starting point (circuit).
D1	decision variable	In a linear programming problem: a item being bought or sold, etc
D1	degree	a number of edges connected to a vertex (valence, order).
D1	digraph	graph in which some edges have a direction (directed edges).
D1	Dijkstra's algorithm	A method for finding the shortest path between two vertices in a network.
D1	dummy	Shows precedence (route order) without adding activities or weight.
D1	early event time	earliest an activity may be started.
D1	edge	line connecting two vertices (arc).
D1	Eulerian graph	A graph in which every vertex is even.
D1	Eulerian graph	a graph in which every vertex has even order.
D1	First-fit decreasing algorithm	A bin-packing algorithm, similar to 'first-fit' but using an ordered list.
D1	Gantt chart	Scheduling diagram that shows time intervals in which activities can take place.
D1	Kruskal's algorithm	A way of finding minimum spanning trees by adding arcs in order of weight.
D1	Linear programming	A way of finding an optimal solution to a problem subject to constraints.

D1	Minimum spanning tree	A spanning tree of a graph with the smallest possible total weight.
D1	node	Points on a graph. Also called vertices.
D1	Optimal solution (bin-packing)	Solution using the smallest number or bins.
D1	pivot	Usually the 'middle' of a list. Used for sorting & searching algorithms.
D1	subgraph	A graph where all the vertices and arcs are from a larger graph. 'Part of a graph.'
D1	Trace table	A table used to keep track of a algorithm.
D1	weight	Number associated with an edge of a graph. For example, showing distance.
S Old	biased sample	a sample which does not fairly represent the population it is taken from
S Old	continuous uniform distribution	a rectangular continuous probability distribution where all values in a given range are equally likely
S Old	mode	the value at which the probability density function is a maximum
S Old	parameter	a quantity that describes a characteristic of a population
S Old	piecewise function	function described by different formulas for different ranges
S Old	Poisson distribution	discrete probability distribution which models a constant rate of events
S Old	probabiity function	shows probabilities of a variable taking a particular value
S Old	probability density function (pdf)	a function f(x) - the integral of which gives the probability of a value occurring
S Old	sample mean	used to estimate the mean of a population
S Old	sampling distribution	probability distribution of a statistic giving all possible values in a big table along with their probabilities
S Old	expected value	the expected value of a random variable is the expected mean of a large data set
S Old	expected value	of a random variable - mean of a data set - sum of values x probability
S Old	residual	the difference between a real-life observation and the regression line
S Old	skewness	a measure of how symmetrically distributed a set of data is
S Old	stem and leaf diagram	diagram to display discrete data, ordered in, say, 10's - must include a key
S Old	???	individual members of the population

M1	coefficient of friction	constant of proportionality: friction force is directly proportional to normal reaction force
M1	component of force	a force resolved into two force parts - usually 'x and y'
M1	compression	the push force in a beam or rod, etc.
M1	force	a push or a pull on a body
M1	friction	a force between two bodies in contact that opposes motion

M1	gravity	a natural phenomena - an attractive effect between any two masses (see weight)
M1	limiting value (of friction)	the maximum value before an object moves
M1	normal force	another name for reaction force (also normal reaction force)
M1	plane	a flat surface
M1	reaction force	the force acting upwards on a body by a surface (see Newton III)
M1	resolving a force	splitting a force vector into two components at right angles to each other
M1	resultant force	the vector sum of two or more forces
M1	scalar	a quantity with magnitude (size) only
M1	smooth surface	a surface modelled as smooth by ignoring friction
M1	speed	the rate of change of distance (scalar)
M1	tension	the pull force in a rope, cable , string, etc.
M1	uniform body	the mass is evenly distributed, concentrated at a point called the centre of mass
M1	vector	a quantity with both magnitude and direction
M1	velocity	the rate of change of displacement (vector)
M1	weight	the force acting on a mass due to gravity

