Mathematics Curriculum for Grades 1–12 of Taiwan and a comparison with that of Japan

I-Liang Chern[1], Ya-Ling Hong[2] and Wei-Chang Shann[2]

In this report we will summarize the structure and spirit of the mathematics curriculum in Taiwan. For grades 1–9 we will present the current standard that was issued in November, 2003. For (academic) high schools (grades 10–12) we will present the transitional standard which was issued in February, 2005, and which will be implemented between 2006 and 2009. These documents were written in traditional Chinese, and translated to English for this report by the third author.

For the purpose of this Japan-Taiwan bilateral symposium, we try make a comparison between Taiwan's curriculum and that of Japan. The Japanese mathematics curriculum listed in this report was based on the document issued in December, 1998 (平成十年). The part of grades 1–9 was based on the Chinese translation by Prof. Lee Yuan-Huei (李園會), that of grades 10–12 was based on the translation by Miss Tsai Chi-Ying (蔡知穎, master degree of liberal arts from Japan). The translation into English for this report was done by the third author.

A curriculum should be designed to interlace different subjects according to pupils' mental developments. But in this report we organize mathematics subjects into five categories for the sake of concentration on mathematical structures. The tables in the following pages are organized according to these categories, and we list them below.

1. Number and mensuration.
2. Algebra (including vectors and coordinates geometry).
3. Mathematical Analysis (including functions).
4. Figure, Solid and Geometry.
5. Discrete Mathematics (including set theory, logic, probability, statistics and combinatorics).

[1] 陳宜良, 國立台灣大學數學系, Department of Mathematics, National Taiwan University.
[2] 洪雅齡, 單維彰, 國立中央大學數學系, Department of Mathematics, National Central University.

Taiwan		Japan	
Number and Mensuration — Integer — Natural Number			
1	≤ 100	1	≤ 100
2	≤ 1000	2	4-digit numbers (≤ 9999)
4	Place names for 10^4 (萬), 10^8 (億) and 10^{12} (兆)	4	Same, with 3-place commas like 10,343
6	Recognize prime numbers and composite numbers, know the concept of being relatively prime, factorization, common factors and multiples, gcd and lcm (continued to grade 7).	6	Similar stuff, with a note on *not* asking too much on gcd or lcm.
10	Euclidean algorithm	12	As an example of programming (optional)
10	Mathematical induction	11	Same, emphasizing the understanding of method
Number and Mensuration — Integer — Negative Number			
7	The use of negative numbers in daily life, interpret them as the *opposite* of some sort of properties.	7	Understand the necessity of negative numbers, able to do the arithmetics about them.
Number and Mensuration — Rational — Fraction			
2	Understand $\frac{1}{m}$ for $m \leq 12$ in concrete situations and make comparison.		
3	Compare and do $\frac{\ell}{m} \pm \frac{n}{m}$ for proper fractions.		
4	$\frac{n}{m} \times k$ allow improper fractions.		
5	Fractions with equal value, mark it on the number line.	5	$\frac{\ell}{m} \pm \frac{n}{m}$ for proper fractions, fractions with equal value.
5	Addition, subtraction and comparison of general positive fractions.	6	Same, starting with proper fractions.
6	Understand the meaning of fraction divisors, know the techniques to handle it.	6	Same.
6	Use gcd and lcm to simplify or expand fractions, apply these techniques to do arithmetics on fractions fluently. Continued to grade 7.	6	Similar stuff completed here.

Taiwan		Japan	
Number and Mensuration — Rational — Decimal			
3	One decimal place, + and −.	4	Same.
4	Two and three decimal places with arithmetics.	5	Two decimal places with arithmetics, transform between forms of decimals and fractions.
5	Multiplication of decimals, round decimals to a specific place, mark them on the number line.		
5	Percentage and discount rate (折).	5	Understand and use percentage.
6	Handle decimal divisors.	6	Understand the meaning of decimal multipliers and divisors, do the computations.
10	Infinitely circular decimal, value of fraction in the sense of limit.	12	Series $\sum r^n$ (no specific assignment on circular decimals?)
Number and Mensuration — Real			
3	The decimal system for positive integers is introduced starting from grade 1, that for decimals is introduced starting from grade 3. Pupils are expected to realize fractions and decimals are two forms of same numbers.	4	Similar stuff.
5	Number line is introduced starting from grade 5 for the nonnegative side, it is completed with the negative side and the concept of absolute value at grade 7.	7	Similar stuff.
7	Approximate large or small numbers by the power of 10 (not specifically the *scientific notation*).		
8	Understand the meaning of surds $\sqrt{n}$, can simplify and approximate them. Do arithmetics about them.	9	Understand the meaning of square roots, use them for problem solving.
10	Prove the irrationality of $\sqrt{2}$, arithmetics about surds, rationalization of numerator or denominator, name "real number."	10	Similar, but excluding $\sqrt{4+2\sqrt{3}} = 1+\sqrt{3}$.

Taiwan		Japan	
Number and Mensuration — Complex			
10	Define i and complex number, arithmetics about complex numbers and their corresponding points on the complex plane.	11	Similar, but this is optional.
10	Polar form of complex numbers: length and principal argument. Roots or unity and the low of de Moivre.		
Number and Mensuration — Length			
1	Direct then indirect comparison of length, measure of length by another object.	1	Same.
2	Understand the meaning between unit and measurement, different values for different units, for instance m and cm.	2	Same, with unit mm too.
3	Relation between units m, cm, mm.	3	Unit km.
4	Unit km.		
Number and Mensuration — Area and Perimeter			
2	Knowing area, direct comparison.		
3	Indirect comparisons between areas, unit cm^2.		
4	Relation between units m^2 and cm^2, perimeter and area of square or rectangle.	4	Treat the same topics all in the 4th grade.
5	Units are (公畝), hectare (公頃) and km^2.		
5	Perimeter and area of triangles, parallelograms and trapezoids.	5	Same without trapezoids.
		5	Perimeter of a circle and area of a disk, understand π and set $\pi \approx 3.14$ or $\pi \approx 3$.
6	Treat the same topics in the 6th grade.	7	Arc length and sector area.
6	Use an appropriate square to approximate the area of a plane region enclosed by curved boundaries.		
8	Surface area of cuboids and basic cylindrical surfaces.	7	Same with basic conic surfaces.

Taiwan		Japan	
Number and Mensuration — Volume, capacity and weight			
2	Knowing capacity and weight, direct comparison.		
3	Units ℓ, mℓ and g, kg.	3	Similar.
4	Indirect comparisons between areas, unit cm^3.		
5	Relation between units m^3 and cm^3, understand the relation between volume and capacity.	6	Similar.
5	Relation between units ton (公噸) and kg.		
5	Volume of cubes and cuboids.	6	Same.
6	Volume of basic cylindrical solids.	7	Same with basic conic solids.
11	Volume of spheres.		(Not specified.)
Number and Mensuration — Angle			
2	Sense of horizontal and vertical (plumb) lines, extend to parallel and perpendicular lines.		
3	Recognize angles and make comparisons.		
4	Measure and reproduce angles up to 180°.	4	Treat all of these topics at 4th grade.
4	Angle in the sense of turning.		
6	Understand the meaning of 180° and 360°.		
10	Generalized angles and radian.	11	Same.
Number and Mensuration — Time			
1	Read exact and half hours from a clock, read weekday and date from a calendar.		
2	Read hour and minute.	2	Same.
3	Relation between units of day, hour, minute and second. + and − within same unit.	3	Similar.
4	Addition and subtraction between different units of time.		
5	Multiplication and division of time.		

Taiwan		Japan	
Algebra — Expressions			
1	Addition/subtraction expressions in written and spoken forms.	1	Same.
2	Express addition/subtraction problems in an expression with an empty box.		
		2	Express multiplication in written and spoken forms.
3	Express multiplication/division problems in an expression with an empty box.		
		3	Express division in written and spoken forms.
4	Express relationships, for instance area of rectangles or squares, in terms of (Chinese) words.		
4	Understand an empty box as an unknown number, relate to real-world problems.		
5	Solve one-step problems with an empty box in the equation, and verify the answer.		
6	Use x, y, etc for unknown symbols. Use the symbols in two-step problems.	7	Similar topics are covered in 7th and 8th grades.
7	Manipulate algebraic symbols fluently.		
8	Manipulate formulae like $(x \pm y)^2$, $(x+y)(x-y)$ and $(x+a)(y+b)$ fluently.	9	Similar stuff with $(x+a)(x+b) = x^2 + (a+b)x + ab$.
Algebra — Rules			
1	Discover that addition is commutative and associative, use them.		
2	9×9 table, understand and use it.	2	Same.
2	Discover that multiplication is commutative, use it.		
2	Understand subtraction is inverse to addition (observe the fact in 1st grade), and use it to verify a computation.	3	Complete the same task but involve larger numbers.

Taiwan		Japan	
Algebra — Rules (Cont.)			
4	Understand division is inverse to multiplication (observe the fact in 3rd grade), and use it to verify a computation.	4	Complete the same task with an emphasis on dividend = divisor × quotient + remainder.
4	Understand $(a \times b) \div c = (a \div c) \times b$ and $(a \div b) \div c = a \div (b \times c)$ whenever it is meaningful.	4	Understand $(a \times c) \div (b \times c) = (a \div c) \div (b \div c) = a \div b$ whenever it is meaningful.
5	Understand the distribution of multiplication to addition, use it.		
6	Understand *equality*: Given $a = b$, then $a \pm c = b \pm c$, $a \times c = b \times c$ and $a \div c = b \div c$ whenever $c \neq 0$.		
7	Exponent rules like $3^2 \times 3^4 = 3^6$ and $3^0 = 1$. Understand and manipulate forms r^m where r is a fraction and m is a nonnegative integer.		
10	The technique of rationalization for $\sqrt{n} \pm \sqrt{m}$.		
10	The technique of turning a complex denominator to real.		
Algebra — Ratio			
6	Understand rate, ratio and direct proportion, take "speed" as a specific example, solve simple problems.	6	Understand the meaning of rate and direct proportion by tables or statistical graphs. Do *not* discuss the numerical value of the ratio.
7	Understand direct and inverse (simple) proportion, convert between forms of $a : b$ and $\frac{a}{b}$ fluently, build and solve rate equations.	7	Similar with making tables and graphs.
7	Understand compound proportion and apply it.		
Algebra — Polynomial Equations			
7	Understand and construct equations of the form $ax + b = 0$, solve them first by substitution and trial, then by algebraic manipulation, be able to verify the answers.	7	Same stuff.

Taiwan		Japan	
Algebra — Polynomial Equations (Cont.)			
8	Understand and construct quadratic equations, understand the meaning of their solutions. Solve them by factirization, completing the square and formua. Apply them on word problems.	9	Similar stuff, with specific remarks on doing problems of the form $ax^2 = b$ (rational coefficients) and $x^2 + px + q = 0$ (real coefficients) which have real solutions. Solve equations which cannot be factorized by completing the square, but do not enforce the formula.
Algebra — Polynomial			
8	Factorization by basic multiplication rules and cross formula, understand factors, multiples and common factors, use them as techniques of factorization.	9	Similar stuff, including a polynomial multiplied or divided by a linear factor.
10	Multiplication and division of polynomials.		
10	Factorization of polynomials.	10	Factorization and expansion of polynomials.
10	Propositions of factors or remainders, test of linear factors.	11	Proposition of factors.
10	Common factors and common multiples, find the highest degree common factors by the (generalized) Euclidean algorithm.		
10	The fundamental theorem of algebra, complex roots arises by conjugate pairs.	11	Polynomials of degree 2 or 3 with simple coefficients which may have complex roots.
Algebra — Inequalities			
7	Understand and construct inequalities of the form $ax + b \geq 0$, solve them and understand the meaning of solutions.	10	Polynomial inequalities of degree 1 or 2.
12	Proof of some absolute inequalities like $\sqrt{xy} \leq (x + y)/2$ and Cauchy inequality.	11	Proof of some equalities and inequalities.
12	Label the solution intervals or regions for polynomial inequalities of degree 1 or 2.	11	Similar topics.
12	Use algebraic of graphic methods to find the maxima or minima under constraints. Application to linear programming.		

Taiwan		Japan	
Algebra — Trigonometry			
10	Trigonometric ratios between 0° and 90°, at special angles like 30° and 60°.	10	Similar, but specifically confines the topics on sine, cosine and tangent for angles between 0° and 180°.
10	Look up and interpolate the sine table.		
10	Basic relationships like reciprocal, squared sum, quotient, complement supplement.	11	Similar stuff.
10	Basic rules like sine rule, cosine rule and Heron rule.	10	Sine and cosine rules within 180°, with a note that do not involve too much of the Heron rule.
10	Applications on measurements.	10	Similar.
10	Algebraic formulae like angle sum, double angle, half angle and product-to-sum.	11	Formulae of angle sum and double angle.
Algebra — Linear Algebra			
7	Understand and construct systems of linear equations with two unknowns, understand the meaning of their solutions, solve them fluently by eliminatiing one of the variables.	8	Similar stuff.
11	System of linear equations with 2 or 3 unknowns, systematic ways of solution: Gaussian elimination with augmented matrix, Cramer's rule. Continued to grade 12 and write the system in terms of matrices. (optional).	12	System of linear equations in form of $Ax = b$ where A is within 3×3. The solution is treated as matrix quotient.
12	Determinants for square matrices of order 2 or 3. Algebraic and geometric properties of determinants.		
12	Inverse matrix of order 2.	12	Same.
12	Sum and scalar multiplication of matrices.	12	Same, with a note that confines the order ≤ 3.
12	Matrix products and row operations.		
Algebra — Coordinates Geometry – 2D			
7	Cartesian coordinates of a plane, soon after the introduction of a complete number line.	7	Similar.

Taiwan		Japan	
Algebra — Coordinates Geometry – 2D (Cont.)			
7	Sketch lines according to equations $y = ax + b$ or $ax + by = c$.		
7	Present the solution of a system of linear equations with two unknowns by two lines on the plane.		
9	Relation between two circles.	10	Inscribed quadrilaterals of a circle, relation between two circles.
10	Slope and intercept of a line. Apply it to find, say, the coordinates of the incenter of a triangle.		
10	Polar coordinates (mentioned lightly).	12	Polar coordinates and polar equations.
11	Parametric line equations	11	Similar topics.
11	Point-line distance and the application of inner product to orthogonal projections and angles between two lines.		
Algebra — Vectors			
11	Concept of vectors, their operations like addition, subtraction, scalar multiplication and inner product.	11	Same stuff.
11	Application of vectors on geometry (line joining bisection points on the two sides of a triangle, parallelogram theorem).		
Algebra — Coordinates Geometry – Conic Sections			
11	Equations for circles (this is actually an implicit function, but we do not say it this way).	11	Same stuff.
11	Relations between line and circle.	11	Same stuff.
11	Standard equations for conic sections: ellipse, hyperpola (with asymptotes) and parabola, their mathematical properties about directrix and focus (or foci).	12	Similar stuff, allow translation but not rotation.
		12	Conic sections in forms of parametric euqations and polar equations.
11	Optic properties of conic sections.		

Taiwan		Japan	
Algebra — Coordinates Geometry – 3D			
11	Cartesian coordinates of three dimensions.	11	Same.
11	Plane equations (normal vector of a plane) and parametric line equations	11	Similar, but restrict the plane equations to $z = k$.
11	Angle between two planes. Point-point, point-plane, line-line (parallel or oblique) distances.		
11	Equations for spheres, relations between sphere and plane.		
Algebra — Recursion			
11	Recursion of the forms $a_n = \alpha a_{n-1} + f(n)$ and $a_n = \beta a_{n-1} + \gamma a_{n-2}$, where $f(x)$ is a polynomial of degree ≤ 2.		

Taiwan		Japan	
Mathematical Analysis — Function			
		4	Recognize relationship between quantities in simple situations, build a table and discuss the relationship.
		5	Understand the meaning of correspondence between two quantities, continued to grade 6.
6	Grasp the meaning of a *variable* by constructing tables according to rates or geometric formulae.	7	Terminologies *variable* and *domain*.
7	Concepts of *function* and variable, understand that direct proportions are examples of linear functions.	8	Be able to find *function* relations, understand linear functions and its relation to direct proportions.
10	Introduce funtion formally and conclude the functions learned so far (polynomial exponential, logarithmic and trigonometric functions).	9	Recognize a function relation between two variables from a concrete situation, and realize that the real world can be described by functions.
10	(Observe the relation between exponential and logarithmic functions, but need not mention the term *inverse function*.)	12	Composite function and inverse function.
Mathematical Analysis — Polynomial Functions			
7	Understand linear functions.	8	Similar stuff.
9	Quadratic function, its maximum or minimum, and graph it by completing the square. Parabola and its symmetry.	10	Understand quadratic functions, graph it; maximum and minimum are studied at grade 11.
12	Derivatives of polynomial functions by the binomial expansion.	12	Derivatives of polynomials of degree ≤ 3.
Mathematical Analysis — Exponential and Logarithm			
10	Exponential functions with simple integer bases, their graphs.	11	Exponential functions.
10	Logarithmic function with base 10, its graph. Pupils may use calculators, but in fact they are taught to look up and interpolate the table.	11	Logarithmic function, do not include the computational rules of logarithms.
		12	e^x and the natural logarithm and their derivatives.

Taiwan		Japan	
Mathematical Analysis — Rational Functions			
		11	Rational functions with first or second degree denominators.
Mathematical Analysis — Trigonometric Functions			
10	Generalize angles and radians, extend trigonometric ratios to functions. Know the graphs of sine, cosine and tangent (the other three are included in appendix).	11	Similar but do not discuss cot, sec and csc.
10	Linear combination of sine and cosine functions.	11	Apply angle sum formula to this level: $a\sin\theta + b\cos\theta = \sqrt{a^2+b^2}\sin(\theta+\alpha)$.
		12	Derivatives of sin, cos and tan.
Mathematical Analysis — Sequence and Series			
8	Recognize finite arithmetic sequences with their common differences, find the general term and apply to solve word problems.		
10	Sequence, general term.	11	Sequence, general term, a two-term relation. Arithmetic sequence and geometric sequence, other forms of sequence like (n^2).
10	Arithmetic series and geometric series, finite or infinite (with an introduction of limit), the $\sum$ notation, applied to circular decimals.	12	Sum of geometric series $\sum r^n$, finite or infinite (with the limit of a sequence).
Mathematical Analysis — Limit			
10	Sum of infinite series in terms of the limit of sequence.	12	Same stuff.
12	Limit of functions (Δx and Δy notation).	12	Same stuff.
Mathematical Analysis — Differential Calculus			
12	Tangent line throught the limit of secant lines. Derivative as the slope of tangent lines, derivative functions.	11	Derivatives and tangent lines for polynomials of degree ≤ 3.
		12	The sum and product rules of differentiation, quotient rule applied to rational functions of degree not exceeding $(2,2)$, and chain rule applied to the forms like $\sqrt{ax+b}$ or $\sqrt{ax^2+b}$.

Taiwan		Japan	
Mathematical Analysis — Differential Calculus (Cont.)			
12	Increasing, decreasing and critical points of the graph of a function.	11	Taught at grades 11 (polynomials) and 12 (other elementary functions).
12	Second derivative applied to the concavity and points of reflection of the graph of a function.	12	Similar stuff.
12	Relative extrema, the test of them, and the applications.		
12	Meaning and applications of derivatives on physics (velocity, acceleration, free fall or projectile).	12	Same stuff.
		12	Mean value theorem (intuitively).
12	Newton's method applied to approximate $\sqrt{n}$.		
Mathematical Analysis — Integral Calculus			
6	Use an appropriate square to approximate the area of a plane region enclosed by curved boundaries.		
12	Antiderivative.	11	Indefinite integral for polynomials of degree ≤ 2, others at grade 12.
12	Definite integrals (the fundamental theorem of calculus is presented in appendix).	11	Definite integrals and area under curves for polynomials of degree ≤ 2, others at grade 12.
12	Riemann sum (intuitively) that links definite integral with the area under a curve.		
12	Application of definite integrals: area of a disk, volume of a ball, volume of a cone (method of slicing), free fall motion.	12	Application of definite integrals (area and volumn).
		12	Integration technique: substitution (limited to $ax+b=t$ and $x=a\sin\theta$) and integration by parts.

Taiwan		Japan	
Figure, Solid and Geometry — Awareness			
1	Recognize and categorize basic shapes and solids. Describe positions by front/back, left/right, atop/beneath and far/near subjectively.	1	Similar, starting from solids.
		2	Recognize various figures, especially triangles and quadrilaterals, by observation, construction and decomposition.
		3	Recognize sqaures, rectangles and right triangles, recognize them as the faces of box-shaped solids, draw and construct these solids.
4	Recognize basic triangles and quadrilaterals by observing the features on angles and edges (perpendicular or parallel), and by constructing these figures.	4	Recognize and reproduce special triangles like regular and isosceles.
5	Similar stuff.	5	Recognize parallelograms, trapezoids, rhombi, be able to drawn them.
5	Recognize basic solids (cubes and cuboids) by observing the features on vertices, edges and faces.	6	Recognize cubes and cuboids, be able to represent the shapes on 2D drawings.
5	Recognize sectors and central angles of a disk. Understand the meaning of 180° and 360°.		
5	Line symmetry: find the symmetric line of a figure, knowing the relationships among symmetric figures, sketch mirror image across a line.	7	Understand the meaning of line symmetry and point symmetry, apply these understandings to deepen the intuition on plane figures.
6	Recognize cones, cylinders and prisms.	6	Recognize triangular and rectangular prisms and cylinders, do not ask pupils to draw them.
Figure, Solid and Geometry — Investigation			
4	Understand the meaning of figures being congruent.		
5	Understand by activities that inner angles of a triangle sum up to 180°, and the sum of lengths of any two sides is larger than that of the third.	5	Discuss the sum of inner angles for a triangle.

Taiwan		Japan	
Figure, Solid and Geometry — Investigation (Cont.)			
6	Understand the scaling ratio and the effects of scaling on length, area and angle.		
8	Nets of cubes, cuboids, cones, pyramids, prisms and cylinders.	6	Nets of cubes and cuboids, but not those of cylinders.
		8	Relation between angles on the center and on the circumference to a cord of a circle.
9	Find out corresponding edges and angles among similar polygons, understand the properties of similar triangles, apply them to measure length or distance.	9	Understand the meaning of similarity and know how to use it, use similar triangles to verify some properties of figures.
9	Line segments between parallel lines.	9	Same stuff.
Figure, Solid and Geometry — Formal Reasoning			
6	Simple reasonings, for instance from the knowledge of triangles to derive the sum of inner angles for a quadrilateral.		
8	Understand the meaning of construction by ruler and compasses, be able to perform basic tasks like constructing a perpendicular bisection line, line that bisects an angle, and line parallel to a given line.	7	Similar constructions.
8	Formally define geometric figures, their vertices, edges and angles. Formally identify special kinds of triangles.	8	Formally identify the properties of triangles and parallelograms.
8	Understand the properties of congruent triangles (SSS etc.) by means of construction by ruler and compasses.	8	Same stuff.
		8	The meaning and method of a *proof* by geometric propositions.
8	Understand the difference between a proposition and its convers.		
8	Understand the Pythagoras theorem, verify it by numerical experiments, apply it to derive mathematical properties.		(9 or Math A at 10?)

Taiwan		Japan	
Figure, Solid and Geometry — Formal Reasoning (Cont.)			
9	Derive mathematical propositions by properties of parallel lines.		
9	Definition, properties and applications of excenter, incenter and centroid of triangles.	10	Same stuff.
9	Learn mathematical reasoning by properties of triangles and circles.		

Taiwan		Japan	
Discrete Mathematics — Descriptive Statistics			
1	Keep record, count, categorize and make a table or chart.	2	Categorize simple things, record by numbers and present by statistical tables or charts.
3	Read 1-D and 2-D tables which may have seen in daily activities.	3	Read and make histograms.
4	Read bar charts, line charts and pie charts seen in daily life, including more complicated bar charts.		
5	Collect data from daily life and make line charts.	4	Collect data according to some purpose, categorize and investigate the statistics of the data: discuss their correlation, consider if there might be something missing or repeated, present data by line charts and discuss the features and trends from these charts.
5	Collect ordinal data and make bar charts or pie charts.	5	Categorize data according to some purpose, make bar charts or pie charts to present the data.
9	Construct frequency table from raw data and make charts or plots for presentation.	11	Similar topics
9	Understand average, median and mode.	6	Understand average and can apply it.
9	Understand range and the first, second and third quartile.		
Discrete Mathematics — Probability and Statistics			
9	Introduce probability in concrete situations, understand the nature of uncertainties.		
11	Properties of probability.	10	Probability and its basic principles: independent experiments, exclusive events and complement events.
11	Sample space, events.	12	Sample and sample space.
11	Sampling methods.		
11	Expected value, standard deviation, confidence interval and confidence level.	11	Data analysis (mean, deviation, standard deviation, etc.)
11	Random number generator (table).		

Taiwan		Japan	
Discrete Mathematics — Probability and Statistics (Cont.)			
11	Normal distribution.	12	Random variable and its distributions, the continuous random variable and the normal distribution.
12	Correlation coefficient, scattering plot and regression line. (Optional)		
12	Independent events, conditional probabilities and Bayes theorem.	12	Conditional probabilities.
12	Binomial distribution.	12	Same.
12	Cross-tabulation analysis.		
Discrete Mathematics — Set Theory			
		10	Understand the inclusion relation and the Venn diagram of sets.
Discrete Mathematics — Logic			
10	Understand *proof* (in Appendix).	10	Propositions: counter-positive statements, sufficient and necessary conditions.
Discrete Mathematics — Permutations and combinatorics			
11	Event counting, inclusion-exclusion and addition-product principles.		
11	Factorial and permutations.	10	Same stuff.
11	Combinatirics and binomial theorem.	10	Same stuff.