

CV of Dr. Takeo Kojima

Name: Takeo Kojima

Affiliation: Yamagata University

Position: Professor

Date Prepared: May 30, 2017

Day and Place of Birth: March 22, 1969, Japan

Education

- March 1992 : B.S. Kyoto University, School of Science
- March 1994 : M.S. Kyoto University, School of Science
- March 1997 : Dr.S. Kyoto University, School of Science

Academic Appointment

- April 1996- March 1998 : JSPS Fellow, Kyoto University
- April 1998- March 2001 : Assistant Professor, Nihon University
- April 2001- March 2010 : Senior Lecturer, Nihon University
- April 2010- March 2015 : Associate Professor, Yamagata University
- April 2015- Present : Professor, Yamagata University

Other Professional Position

- 1997 : Visiting Research Associate, New-York State University (US)
- 2006-2010 : Visiting Lecturer, University of Tokyo
- 2013 : Invited Professor, University of Tours (France) (Visiting Professorship)

Papers

- [1] M. Jimbo, T. Kojima, T. Miwa and Y. H. Quano : Smirnov's integrals and the quantum Knizhnik-Zamolodchikov equation of Level 0, *J. Phys.* **A27**, no.9, 3267-3283, (1994).
- [2] T. Kojima and Y. H. Quano : Quantum Knizhnik-Zamolodchikov equation for $U_q(\widehat{sl}_n)$ and integral formula, *J. Phys.* **A27**, no.20, 6807-6826, (1994).
- [3] T. Kojima, K. Miki and Y. H. Quano : Annihilation poles of a Smirnov-type integral formula for solutions to the quantum Knizhnik-Zamolodchikov equation, *J. Phys.* **A28**, no.12, 3479-3491, (1995).
- [4] M. Jimbo, R. Kedem, T. Kojima, H. Konno and T. Miwa : XXZ chain with a boundary, *Nucl. Phys.* **B441**, no.3, 437-470, (1995).
- [5] T. Kojima : Ground-state correlation functions for an impenetrable Bose gas with Neumann or Dirichlet boundary conditions, *J. Stat. Phys.* **88**, no.3-4, 713-743, (1997).
- [6] T. Kojima and V. Korepin : The Maxwell Bloch equation and correlation functions for the penetrable Bose gas, *J. Phys.* **A30**, no.14, 5105-5121, (1997).
- [7] T. Kojima, V. Korepin and N. Slavnov : Determinant representation for dynamical correlation functions of the quantum NS equation, *Commun. Math. Phys.* **188**, no.3, 657-689, (1997).
- [8] T. Kojima, V. Korepin and N. Slavnov : Completely integrable equation for the quantum correlation functions of the quantum NS equation, *Commun. Math. Phys.* **189**, no.3, 709-728, (1997).
- [9] T. Kojima : Dynamical correlation functions for an impenetrable Bose gas with Neumann or Dirichlet boundary condition, *J. Nonlinear Math. Phys.* **6**, no.1, 99-199, (1999).
- [10] H. Fukushima and T. Kojima : Spontaneous Polarization of the Kondo problem associated with the higher spin six vertex model, *J. Phys.* **A32**, no.34, 6149-6168, (1999).

- [11] H. Furutsu and T. Kojima : The $U_q(\widehat{sl}_N)$ -analogue of the XXZ chain with a Boundary, *J. Math. Phys.* **41**, no.7, 4413-4436, (2000).
- [12] H. Furutsu, T. Kojima and Y.H. Quano : Form factors of the $SU(2)$ invariant massive Thirring model with boundary reflection, *Int. J. Mod. Phys.* **A15**, no.19, 3037-3052, (2000).
- [13] H. Furutsu, T. Kojima and Y.H. Quano : Type-II Vertex Operators for $A_{N-1}^{(1)}$ Face Model, *Int. J. Mod. Phys.* **A15**, no.10, 1533-1556, (2000).
- [14] T. Kojima and Y.H. Quano : The Difference equations for the higher rank XXZ model with a boundary, *Int. J. Mod. Phys.* **A15**, no.23, 3699-3716, (2000).
- [15] T. Kojima: The free field approach to the higher rank XXZ chain with a boundary, *J. Nonl. Analysis.* **47**, 5187-5198, (2001).
- [16] T. Kojima and S. Yamasita : The critical $A_{N-1}^{(1)}$ chain, *J. Phys.* **A34**, no.6, 1181-1201, (2001).
- [17] T. Kojima: The 19 Vertex Model at Critical Regime $|q| = 1$, *Int. J. Mod. Phys.* **A16**, no.9, 1559-1578, (2001).
- [18] T. Kojima: The Massless XXZ chain with a Boundary, *Int. J. Mod. Phys.* **A16**, no.3, 409-424, (2001).
- [19] T. Kojima: Form factors of the $SU(N)$ Invariant Massive Thirring Model with Boundary Reflection, *Int. J. Mod. Phys.* **A16**, no.15, 2665-2689, (2001).
- [20] T. Kojima: The Affine $A_{N-1}^{(1)}$ Toda Fields with Boundary Reflection, *Int. J. Mod. Phys.* **A17**, no.4, 487-513, (2002).
- [21] T. Kojima: The quantum Knizhnik-Zamolodchikov equations associated with $U_q(A_2^{(2)})$ for $|q| = 1$, *Int. J. Mod. Phys.* **A18**, no.2, 225-248, (2003).

- [22] T.Kojima and H.Konno: The Elliptic Algebra $U_{q,p}(\widehat{sl}_N)$ and the Drinfeld Realization of the Elliptic Quantum Group $\mathcal{B}_{q,\lambda}(\widehat{sl}_N)$, *Commun. Math. Phys.* **239**,405-447, (2003).
- [23] T.Kojima and H.Konno : The Elliptic Algebra $U_{q,p}(\widehat{sl}_N)$ and the Deformation of the W_N Algebra, *J.Phys.***A37**,no.2,371-383, (2004).
- [24] T.Kojima and H.Konno : The Drinfeld Realization of the Elliptic Quantum Group $\mathcal{B}_{q,\lambda}(A_2^{(2)})$, *J.Math.Phys.***45**, 3146-3179, (2004).
- [25] T.Kojima, H.Konno and R.Weston: The Vertex-Face Correspondence and Correlation Function of Elliptic Vertex Models I : General Formalism, *Nucl.Phys.***B720**, 348-398 (2005).
- [26] B.Feigin, T.Kojima, J.Shiraishi and H.Watanabe: The Integrals of Motion for the Deformed W -Algebra $W_{q,t}(\widehat{sl}_N)$, *Proceedings for Representation Theory* 2006, Atami, Japan, 12 pages, [ISBN4-9902328-2-8], (2006).
- [27] B.Feigin, T.Kojima, J.Shiraishi and H.Watanabe: The Integrals of Motion for the Deformed Virasoro Algebra, Preprint 54 pages, [arXiv.0705.0427].
- [28] T.Kojima, J.Shiraishi : The Integrals of Motion for the deformed W -algebra $W_{q,t}(\widehat{gl}_N)$ II. Proof of the commutation relations, *Commun.Math.Phys.***283**, 795-851, (2008).
- [29] T.Kojima, J.Shiraishi : The Integrals of Motion for the deformation of the Virasoro and W_N -algebra, *J.Nonl.Analysis.* 02/2009; 71(12-71), doi:10.1016/j.n.a.2009.
- [30] T.Kojima, J.Shiraishi: A remark on the integrals of motion associated with level k realization of the elliptic algebra $U_{q,p}(\widehat{sl}_2)$, *J.Geometry, Integrability and Quantization* **X**, 183-196, (2009).
- [31] T.Kojima : The Baxter's Q-operaor for the W -algebra W_N , *J.Phys.A:Math.Theor.* **41** No 35 (5 September 2008) 355206 (16pp) .
- [32] T.Kojima : Wakimoto realization of Drinfeld current for the elliptic quantum group $U_{q,p}(\widehat{sl}_3)$, *Physics of Atomic Nuclei*, vol.78, 367-374, (2010).

- [33] T.Kojima: Wakimoto realization for the elliptic quantum group $U_{q,p}(\widehat{sl}_N)$ and its application to the integrals of motion, *Int.J.Mod.Phys.***A30**, 5561-5578, (2009).
- [34] T.Kojima: Free field realization of commutative family of elliptic Feigin-Odesskii algebra, *RIMS Kokyuroku* **1700**,11-32, (2010).
- [35] T.Kojima: Diagonalization of boundary transfer matrix for the $U_{q,p}(\widehat{sl}(3, \mathbf{C}))$ ABF model, *American Institute of Physics Conference Proceedings* **1243**, p.241-253 (2010).
- [36] T.Kojima: Diagonalization of infinite transfer matrix of boundary $U_{q,p}(A_{N-1}^{(1)})$ Face model, *J.Math.Phys.*52,013501 (2011);doi:10.1063/1.3521604 (26 pages).
- [37] T.Kojima: Free field approach to diagonalization of the boundary transfer matrix, *Journal of Physics A: Conference Series* **284**, 012041, (2011),
- [38] T.Kojima: Infinitely many commuting operators for the elliptic quantum group $U_{q,p}(\widehat{sl}_N)$, *Proceedings of 6th Mathematical Physics Meeting, held in Belgrade, Serbia*, 235-250, (2012) [ISBN:978-86-22441-30-4].
- [39] T.Kojima: A remark on ground state of boundary Izergin-Korepin model, *Int.J.Mod.Phys.***A26**, 1973-1989, (2011).
- [40] T.Kojima: Elliptic Deformed Superalgebra $U_{q,p}(\widehat{sl}(M|N))$, *J.Phys.***A44**: Math.Theor. 485205(23pages), (2011).
- [41] T.Kojima: Free Field Realization of Quantum Superalgebra $U_q(\widehat{sl}(N|1))$, *J.Math.Phys.***53**, 013515(15pages), (2012).
- [42] T.Kojima: The Wakimoto Realization of the Superalgebras $U_q(\widehat{sl}(N|1))$ and $U_{q,p}(\widehat{sl}(N|1))$, *Springer Proceedings : Mathematics and Statistics*, **36**, 263-276 (2013), doi:10.1007/978-4-431-54270-4.
- [43] T.Kojima: Screenings and Vertex Operators of Quantum Superalgebra $U_q(\widehat{sl}(N|1))$,

*J.Math.Phys.***53**, 083503(30pages) (2012), doi:10.1063/1.4742125.

[44] T.Kojima: Bosonization and Vertex Operator of Supersymmetry $U_q(\widehat{sl}(N|1))$ for Level k , *J.Phys.A:Conf.Ser.***410**, 02062 (2013), doi:10.1088/1742-6596/410/1/12062.

[45] T.Kojima: Diagonalization of Transfer Matrix of Supersymmetry $U_q(\widehat{sl}(M+1|N+1))$ Chain with a Boundary, [arXiv.1211.2912], *J.Math.Phys.***54**, 043507 (40pages) (2013), doi:10.1063/1.4799933

[46] T.Kojima: Bosonization of Superalgebra $U_q(\widehat{sl}(N|1))$ for an arbitrary level, *Proceedings of 7-th Mathematical Physics Meetings*, 229-244, (2013) [ISBN:978-86-82441-38-0].

[47] P.Baseilhac, T.Kojima: Correlation functions of the half-infinite XXZ spin chain with a triangular boundary, *Nucl.Phys.***B880**, 378-413 ,(2014).

[48] T.Kojima: Vertex operator approach to semi-infinite spin chain : recent progress, *Lie Theory and Its Applications in Physics* (Springer Proceedings in Mathematics and Statistics) **111**, 265-277, (2014), DOI 10.1007/978-4-431-54270-4.

[49] P.Baseilhac, T.Kojima: Form factors of the half-infinite XXZ spin chain with a triangular boundary, *J.Stat.Mech.*, P09004(34 pages), (2014), doi:10.1088./1742-5468/2014/09/P09004

[50] T.Kojima: Boundary state of $U_q(\widehat{gl}(N|N))$ analogue of half-infinite $t-J$ model, *J.Stat.Mech.* 023108(38 pages) (2016).

[51] T.Kojima: A bosonization of $U_q(\widehat{sl}(M|N))$, arXiv.1701.03645, *Communication in Mathematical Physics* **355**, 603-644 (2017)

Grant Information

- **JSPS**

[1] April 1996-March 1998

Exact solutions of solvable models

JSPS Grant for JSPS Fellow, Role: PI

[2] April 1999-March 2001

Integral Representation of Exactly Solvable Lattice Models

JSPS Grant for Encouragement of Young Scientist (A), Role: PI

[3] April 2002-March 2005

Elliptic Quantum Group Approach to Solvable Models

JSPS Grant for Young Scientist (B), Role: PI

[4] April 2006-March 2009

Study on Screening Current of Elliptic Deformed W-Algebra

JSPS Grant for Young Scientist (B), Role: PI

[5] April 2009-March 2014

Free Field Realization Vertex Operator and T-Q Operator of Elliptic Quantum Group

JSPS Grant for Basic Research (C), Role: PI

[6] April 2014-March 2019

Free Field Approach to Exactly Solvable Models associated with Elliptic Algebras

JSPS Grant for Basic Research (C), Role: PI

Teaching Experience

1998

Nihon University

- *Algebra Exercise* ; 3rd year undergraduate students, Group, Field ; 90 min session per a week for 28 weeks, 1 class.
- *Complex Analysis Exercise*, 3rd year undergraduate students, Complex analysis; 90 min session per a week for 28 weeks, 2 classes.

1999

Nihon University

- *Algebra Exercise* ; 3rd year undergraduate students ; Group, Field; 90 min session per a week for 28 weeks, 1 class.
- *Complex Analysis Exercise* ; 3rd year undergraduate students ; Complex analysis; 90 min session per a week for 28 weeks, 2 classes.
- *Seminar* ; 4th year undergraduate students, Lie algebra ; 240 min session per a week for 28 weeks.

2000

Nihon University

- *Algebra Exercise* ; 3rd year undergraduate students ; Group, Field ; 90 min session per a week for 28 weeks, 1 class.
- *Complex Analysis Exercise* ; 3rd year undergraduate students ; Complex analysis; 90 min session per a week for 28 weeks, 2 classes.
- *Seminar* ; 4th year undergraduate students, Orthogonal polynomial; 240 min session per a week for 28 weeks.

2001

Nihon University

- *Calculus I* ; 1st year undergraduate students ; $\varepsilon - \delta$, Riemann integral for one variable etc.; 90 min session per a week for 28 weeks, 1 class.
- *Mathematics Exercise* ; 3rd year undergraduate students ; exercise of Calculus and Linear algebra; 90 min session per a week for 28 weeks, 1 class.
- *Seminar* ; 4th year undergraduate students, KdV equation; 240 min session per a week for

28 weeks.

2002

Nihon University

- *Calculus I* ; 1st year undergraduate students ; $\varepsilon - \delta$, Riemann integral for one variable etc.; 90 min session per a week for 28 weeks, 1 class.
- *Mathematics Exercise* ; 3rd year undergraduate students ; exercise of Calculus and Linear algebra; 90 min session per a week for 28 weeks, 1 class.
- *Seminar* ; 4th year undergraduate students, Painleve equation; 240 min session per a week for 28 weeks.

2003

Nihon University

- *Calculus I* ; 1st year undergraduate students ; $\varepsilon - \delta$, Riemann integral for one variable etc.; 90 min session per a week for 28 weeks, 1 class.
- *Modern Analysis C* ; 3rd and 4th year undergraduate students ; Quantum group; 90 min session per a week for 14 weeks, 1 class.
- *Modern Analysis D* ; 3rd and 4th year undergraduate students ; Elliptic function; 90 min session per a week for 14 weeks, 1 class.
- *Seminar* ; 4th year undergraduate students, Elliptic function; 240 min session per a week for 28 weeks.

2004

Nihon University

- *Calculus IIA* ; 2nd year undergraduate students ; Partial differentiation, Riemann integral for many variables etc.; 90 min session per a week for 28 weeks, 1 class.
- *Calculus IIB* ; 2nd year undergraduate students ; Partial differentiation, Riemann integral for many variables etc.; 90 min session per a week for 28 weeks, 1 class.
- *Modern Analysis C* ; 3rd and 4th year undergraduate students ; Virasoro algebra; 90 min session per a week for 14 weeks, 1 class.
- *Modern Analysis D* ; 3rd and 4th year undergraduate students ; Theta function; 90 min session per a week for 14 weeks, 1 class.
- *Seminar* ; 4th year undergraduate students, Hypergeometric function; 240 min session per a week for 28 weeks.

2005

Nihon University

- *Introduction to Algebra* ; 2nd year undergraduate students ; Group, Field; 90 min session per a week for 28 weeks, 1 class.
- *Calculus IIB* ; 2nd year undergraduate students ; Partial differentiation, Riemann integral for many variables etc.; 90 min session per a week for 28 weeks, 1 class.
- *Modern Analysis A* ; 3rd and 4th year undergraduate students ; Deformed Virasoro algebra and Macdonald polynomial; 90 min session per a week for 14 weeks, 1 class.
- *Modern Analysis B* ; 3rd and 4th year undergraduate students ; Elliptic function; 90 min session per a week for 14 weeks, 1 class.

2006

Nihon University

- *Introduction to Algebra* ; 2nd year undergraduate students ; Group, Field; 90 min session per a week for 28 weeks, 1 class.
- *Introduction to Analysis I* ; 2nd year undergraduate students ; Ordinary differential equation; 90 min session per a week for 14 weeks, 1 class.
- *Introduction to Analysis II* ; 2nd year undergraduate students ; Vector calculus; 90 min session per a week for 14 weeks, 1 class.
- *Linear algebra* ; 3rd year undergraduate students ; Jordan normal form; 90 min session per a week for 14 weeks, 1 class.
- *Seminar* ; 4th year undergraduate students, Macdonald polynomial; 240 min session per a week for 28 weeks.

University of Tokyo

- *Calculus I* ; 1st year undergraduate students ; $\varepsilon - \delta$, Riemann integral for many variable etc.; 90 min session per a week for 28 weeks, 1 class.

2007

Nihon University

- *Introduction to Algebra* ; 2nd year undergraduate students ; Group, Field; 90 min session per a week for 28 weeks, 1 class.
- *Modern Analysis C* ; 3rd and 4th year undergraduate students ; Lie algebra; 90 min session per a week for 14 weeks, 1 class.

- *Modern Analysis D* ; 3rd and 4th year undergraduate students ; Macdonald polynomial; 90 min session per a week for 14 weeks, 1 class.
- *Linear algebra* ; 3rd year undergraduate students ; Jordan normal form; 90 min session per a week for 14 weeks, 1 class.
- *Mathematics Exercise* ; 3rd year undergraduate students ; exercise of Calculus and Linear algebra; 90 min session per a week for 28 weeks, 1 class.
- *Seminar* ; 4th year undergraduate students, Special function; 240 min session per a week for 28 weeks.

University of Tokyo

- *Calculus I* ; 1st year undergraduate students ; $\varepsilon - \delta$, Riemann integral for many variable etc.; 90 min session per a week for 28 weeks, 1 class.

2008

Nihon University

- *Introduction to Algebra* ; 2nd year undergraduate students ; Group, Field; 90 min session per a week for 28 weeks, 1 class.
- *Modern Analysis A* ; 3rd and 4th year undergraduate students ; Fourier analysis; 90 min session per a week for 14 weeks, 1 class.
- *Modern Analysis B* ; 3rd and 4th year undergraduate students ; Ordinary differential equation for complex variable; 90 min session per a week for 14 weeks, 1 class.
- *Linear algebra* ; 3rd year undergraduate students ; Jordan normal form; 90 min session per a week for 14 weeks, 1 class.
- *Mathematics Exercise* ; 3rd year undergraduate students ; exercise of Calculus and Linear algebra; 90 min session per a week for 28 weeks, 1 class.
- *Seminar* ; 4th year undergraduate students, Fourier analysis; 240 min session per a week for 28 weeks.

University of Tokyo

- *Calculus I* ; 1st year undergraduate students ; $\varepsilon - \delta$, Riemann integral for many variable etc.; 90 min session per a week for 28 weeks, 1 class.

2009

Nihon University

- *Introduction to Algebra* ; 2nd year undergraduate students ; Group, Field; 90 min session per a week for 28 weeks, 1 class.

- *Modern Analysis A* ; 3rd and 4th year undergraduate students ; Vector calculus; 90 min session per a week for 14 weeks, 1 class.
- *Modern Analysis B* ; 3rd and 4th year undergraduate students ; Theta function; 90 min session per a week for 14 weeks, 1 class.
- *Linear algebra* ; 3rd year undergraduate students ; Jordan normal form; 90 min session per a week for 14 weeks, 1 class.
- *Mathematics Exercise* ; 3rd year undergraduate students ; exercise of Calculus and Linear algebra; 90 min session per a week for 28 weeks, 1 class.
- *Seminar* ; 4th year undergraduate students, Fourier analysis; 240 min session per a week for 28 weeks.

University of Tokyo

- *Calculus I* ; 1st year undergraduate students ; $\varepsilon - \delta$, Riemann integral for many variable etc.; 90 min session per a week for 28 weeks, 1 class.

2010

Yamagata University

- *Advanced Mathematics* ; 1st and 2nd year graduate students ; 2 dimensional Ising model; 90 min session per a week for 15 weeks, 1 class.
- *Analysis I* ; 2nd year undergraduate students ; Partial differentiation, Riemann integral for many variable etc.; 90 min session per a week for 15 weeks, 3 class.
- *Analysis III* ; 2nd year undergraduate students ; Complex analysis; 90 min session per a week for 15 weeks, 2 class.
- *Probability and Statistics* ; 2nd year undergraduate students ; Probability and Statistics; 90 min session per a week for 15 weeks, 1 class.

2011

Yamagata University

- *Advanced Mathematics* ; 1st and 2nd year graduate students ; 2 dimensional Ising model; 90 min session per a week for 15 weeks, 1 class.
- *Analysis I* ; 2nd year undergraduate students ; Partial differentiation, Riemann integral for many variable etc.; 90 min session per a week for 15 weeks, 3 class.
- *Analysis III* ; 2nd year undergraduate students ; Complex analysis; 90 min session per a week for 15 weeks, 2 class.
- *Probability and Statistics* ; 2nd year undergraduate students ; Probability and Statistics; 90

min session per a week for 15 weeks, 1 class.

2012

Yamagata University

- *Advanced Mathematics* ; 1st and 2nd year graduate students ; 2 dimensional Ising model; 90 min session per a week for 15 weeks, 1 class.
- *Analysis I* ; 2nd year undergraduate students ; Partial differentiation, Riemann integral for many variable etc.; 90 min session per a week for 15 weeks, 3 class.
- *Analysis III* ; 2nd year undergraduate students ; Complex analysis; 90 min session per a week for 15 weeks, 2 class.
- *Probability and Statistics* ; 2nd year undergraduate students ; Probability and Statistics; 90 min session per a week for 15 weeks, 1 class.

2013

Yamagata University

- *Advanced Mathematics* ; 1st and 2nd year graduate students ; 2 dimensional Ising model; 90 min session per a week for 15 weeks, 1 class.
- *Analysis I* ; 2nd year undergraduate students ; Partial differentiation, Riemann integral for many variable etc.; 90 min session per a week for 15 weeks, 4 class.
- *Analysis III* ; 2nd year undergraduate students ; Complex analysis; 90 min session per a week for 15 weeks, 2 class.
- *Probability and Statistics* ; 2nd year undergraduate students ; Probability and Statistics; 90 min session per a week for 15 weeks, 1 class.

2014

Yamagata University

- *Advanced Mathematics* ; 1st and 2nd year graduate students ; 2 dimensional Ising model; 90 min session per a week for 15 weeks, 1 class.
- *Analysis I* ; 2nd year undergraduate students ; Partial differentiation, Riemann integral for many variable etc.; 90 min session per a week for 15 weeks, 3 class.
- *Analysis III* ; 2nd year undergraduate students ; Complex analysis; 90 min session per a week for 15 weeks, 2 class.
- *Probability and Statistics* ; 2nd year undergraduate students ; Probability and Statistics; 90 min session per a week for 15 weeks, 1 class.

2015

Yamagata University

- *Advanced Mathematics* ; 1st and 2nd year graduate students ; 2 dimensional Ising model; 90 min session per a week for 15 weeks, 1 class.
- *Differential and Integral Calculus* ; 1st year undergraduate students ; Differentiation, Riemann integral for one variable etc.; 90 min session per a week for 15 weeks, 2 class.
- *Analysis III* ; 2nd year undergraduate students ; Complex analysis; 90 min session per a week for 15 weeks, 2 class.
- *Probability and Statistics* ; 2nd year undergraduate students ; Probability and Statistics; 90 min session per a week for 15 weeks, 1 class.

2016

Yamagata University

- *Differential and Integral Calculus* ; 1st year undergraduate students ; Differentiation, Riemann integral for one variable etc.; 90 min session per a week for 15 weeks, 2 class.
- *Analysis I* ; 2nd year undergraduate students ; Partial differentiation, Riemann integral for many variable etc.; 90 min session per a week for 15 weeks, 3 class.
- *Probability and Statistics* ; 2nd year undergraduate students ; Probability and Statistics; 90 min session per a week for 15 weeks, 1 class.
- *Advanced Mathematics* ; 1st and 2nd year graduate students ; 2 dimensional Ising model; 90 min session per a week for 15 weeks, 1 class.

2017

Yamagata University

- *Differential and Integral Calculus* ; 1st year undergraduate students ; Differentiation, Riemann integral for one variable etc.; 90 min session per a week for 15 weeks, 2 class.
- *Mathematics C* ; 1st year undergraduate students ; Introduction to linear algebra ; 90 min session per a week for 15 weeks, 2 class.
- *Probability and Statistics* ; 2nd year undergraduate students ; Probability and Statistics; 90 min session per a week for 15 weeks, 1 class.
- *Advanced Mathematics* ; 1st and 2nd year graduate students ; 2 dimensional Ising model; 90 min session per a week for 15 weeks, 1 class.