

DAVID GOLDBERG

EDUCATION

B.A.	Reed College, Portland, OR	1984
Ph.D.	University of Maryland, College Park	1991
	Dissertation: “Reducibility of Induced Representations for Classical p -adic Groups”	

PROFESSIONAL EXPERIENCE

Actuarial Administrator	Fred. S. James & Co., Portland, OR	1984-86
Teaching Assistant	University of Maryland	1986-89
Research Assistant	University of Maryland	1989-91
Research Assistant Professor	Purdue University	1991-94
Member	Mathematical Sciences Research Institute	1994-95
Assistant Professor	Purdue University	1994-97
Associate Professor	Purdue University	1997-2005
Visiting Associate Professor	University of Iowa	1998-99
Visiting Professor	University of East Anglia, Norwich, UK	June – August 2005
Professor	Purdue University	2005-
Visiting Professor	Boston College	January-August 2006
Visiting Professor	Univ. Blaise Pascal Clermont-Ferrand, France	June 2009
Associate Head for Graduate Studies	Purdue University	January 2013-
Executive Director	National Alliance for Doctoral Studies in the Mathematical Sciences	January 2016-
Executive Director	College of Science Center for the National Math Sciences Alliance	March 2017-

PROFESSIONAL MEMBERSHIPS and SERVICE

American Mathematical Society
American Statistical Association
SACNAS
Reviewer Mathematical Reviews
Referee for several research journals

AWARDS

National Science Foundation Postdoctoral Fellow, June 1992-May 1995
National Science Foundation CAREER Award, June 1995-May 1998

Top Ten Teacher in the School of Science, Spring 2000

2017 AMS Programs That Make a Difference Award (National Alliance Executive Director)

RESEARCH INTERESTS

Representations of p -adic groups, especially questions of reducibility of induced representations and their connections with number theory and automorphic forms.

VITA

Birthdate: November 7, 1961 Birthplace: Stoneham,

Massachusetts Citizenship: U.S.A.

PUBLICATIONS

REFEREED

1. *Reducibility of generalized principal series representations of $U(2,2)$ Via Base Change*, Compositio Mathematica, **86**; 245-264, 1993.
2. *Some results on reducibility for unitary groups and local Asai L -functions*, J. reine angew. Math., **448**; 65-95, 1994.
3. *R -groups and elliptic representations for SL_n* , Pacific Journal of Mathematics, **165**; 77-92, 1994.
4. *Reducibility of induced representations for $Sp(2n)$ and $SO(n)$* , American Journal of Mathematics, **116**; 1101-1151, 1994.
5. *R -groups and elliptic representations for unitary groups*, Proceedings of the AMS, **123**; 1267-1276, 1995.
6. *Reducibility for non-connected p -adic Groups with G^0 of prime index*, Canadian Journal of Mathematics, **47**; 344-363, 1995.
7. (with R.A. Herb) *Some results on the admissible representations of non-connected reductive p -adic groups*, Annales Scientifique, ENS, **30**; 97-146, 1997,
8. *R -groups and elliptic representations for similitude groups*, Math. Annalen, **307**; 569-588, 1997.
9. (with F. Shahidi) *On the tempered spectrum of quasi-split classical groups*, Duke J. Math., **92(2)**; 255-294, 1998.

PUBLICATIONS (CONT.)

10. (with S. Friedberg) *On local coefficients for nongeneric representations of some classical groups*, *Compositio Mathematica*, **116**; 133-166, 1999.
11. (with F. Shahidi) *On the tempered spectrum of quasi-split classical Groups II*, *Canad. J. Math.*, **53 (2)**; 244-277, 2001.
12. (with A. Roche) *Types for SL_n* , *Proc. of London Math. Soc.*, **85 (3)**; 119-138, 2002.
13. (with A. Roche) *Hecke algebras for SL_n* , *Proc. of London Math. Soc.* **90(3)**, 87-131, 2005.
14. *On reducibility for SU_n , and generic elliptic representations*, *Canad. J. Math.*, **58(2)**; 344-361, 2006.
15. (with P. Kutzko and S. Stevens) *Covers for self-dual supercuspidal representations of the Siegel Levi subgroup of classical p -adic groups*, *Int. math. Res. Notices*, 2007, no. 22 (31 pages).
16. *On dual R -groups for classical groups*, in "On Certain L -functions; Conference Proceedings on the occasion of Freydoon Shahidi's 60th Birthday, J. Arthur, J. Cogdell, S. Gelbart, D. Goldberg, D. Ramakrishnan, J.K. Yu (eds), Clay Mathematics Proceedings,, Vol. 13, (2011) Amer. Math. Soc. pp. 159-186.
17. (co-Editor) *On Certain L -functions; Conference Proceedings on the occasion of Freydoon Shahidi's 60th Birthday*, (J. Arthur, J. Cogdell, S. Gelbart, D. Goldberg, D. Ramakrishnan, J.K. Yu eds.)Clay Mathematics Proceedings, **Vol. 13**, Amer. Math. Soc. 2011.
18. (With D. Ban) *R -groups and parameters*, *Pac. J. Math* **255**; 281-304, 2012.
19. (with F. Shahidi) *On the tempered spectrum of classical groups, III: The odd orthogonal groups*, *Forum Mathematicum* **26**; 1029-1069, 2014.
20. (with K. Choiy) *Transfer of R -groups between p -adic inner forms of SL_n* , *Manuscripta Mathematica*, **146**; 125-152, 2015.
21. (with D. Ban) *R -groups, elliptic representations and parameters for $GSpin$ groups*, *Forum Mathematicum* **27**, 3301-3334, 2015.
22. (with K. Choiy) *Invariance of R -groups between p -adic inner forms of quasi-split classical groups*, *Transactions of AMS*, **368**; 1387-1410, 2016

PUBLICATIONS (CONT.)

23. (with D. Szpruch) *Plancherel measures for covers of p -adic SL_2 and SO_3* , Inter. J. Number Theory, **12**, 1907-1926, 2016.
24. (with K. Choiy) *Behavior of R -groups for p -adic inner forms of quasi-split special unitary groups*, Bull. Iranian Math. Soc., **43**, 117-141, 2017.
25. *Local aspects of the Langlands-Shahidi Method, and the theory of R -groups*, in “Prime Numbers and Representation Theory”, (Y. Tian and Y. Ye, eds.) Lect. Series of Mod. Num. Thy, **2**, Science Press, Beijing, China, 2017
26. (with D. Ban and K. Choiy) *R -groups and multiplicity in restriction for unitary principal series of $GSpin$ and $Spin$* , in “Geometry, Algebra, Number Theory, and their Information technology Applications”, Springer Proceedings in Mathematics and Statistics, Vol. 251, pp. 59-69, (2018), Springer Nature Switzerland, Cham , Switzerland
27. (with D. Ban and K. Choiy) *R -groups for unitary principal series of $Spin$ groups* (submitted)
28. (With P. Kutzko) “The Math Alliance and Building of a National Mentoring Community”, to appear in *Building Successful Communities and the Importance of Belonging*, edited by D. Dumbaugh and D. Haunsperger (submitted)

IN PROGRESS

29. (with S. Friedberg and D. Szpruch) *Theta representations for covers of classical groups*
30. (with K. Choiy) *R -groups for general metaplectic Groups*
31. (with D. Ban and K. Choiy) *R -groups for spin groups*

NON-REFEREED

32. (Harriet Pollatsek) “Interview with David Goldberg”, Notices of the American Mathematical Society, **63**, 964-966, 2016
33. (With P. Kutzko) “The Math Alliance and Its Roots in the African American Community”, Notices of the American Mathematical Society, **65**, 127-131, 2018

INVITED ADDRESSES

1. University of Chicago Representation Theory Seminar, October 30, 1991. (1 hour)

2. Second annual p -adic Field of Dreams Conference, University of Iowa, April 3-5, 1992. (1 hour)
3. Colloque: Progrès récents en L -indiscernabilité, CIRM, Marseille, France, May 25-29, 1992.
4. Teoría de Representaciones de Grupos Algebraicos Sobre Cuerpos Locales y Aplicaciones, Universidad Católica de Valparaíso, Chile, July 26-30, and Universidad de Chile a Santiago, Chile August 2-6, 1993. (four 1 hour lectures)
5. Universidad Nacional de Córdoba, Argentina, August 10, 11, and 12, 1993. (90 minutes each)
6. University of Maryland Lie Groups and Representation Theory Seminar, November 18, 1993. (1 hour)
7. Colloque: Représentations des groupes réductifs p -adiques, CIRM, Marseille, France, July 25-29, 1994. (1 hour)
8. California State University, Bakersfield, Department of Mathematics Colloquium, February 14, 1995. (1 hour)
9. Reed College, Department of Mathematics Colloquium, March 2, 1995. (1 hour)
10. University of California, Conference on Lie Groups and Lie Algebras, UC Santa Cruz, April 8-9, 1995. (1 hour)
11. University of California, Berkeley, Lie Groups and Representation Theory Seminar, May 3, 1995. (1 hour)
12. American Mathematical Society Northeast Regional Meeting (903), Northeastern University, October 7-8, 1995. (20 minutes)
13. Calvin College Department of Mathematics Colloquium, February 8, 1996. (1 hour)
14. University of Toronto Lie Groups Seminar, March 15, 1996. (1 hour)
15. Universidad Nacional de Córdoba, Argentina, December 19, 1996. (1 hour)
16. Segundo Taller Representaciones Latinoamericano de grupos, Universidad Católica de Valparaíso, Chile, January 6-10, 1997. (5 one hour lectures)
17. Boston College Department of Mathematics Colloquium, March 13, 1997. (1 hour)
18. Tercera Taller Latinoamericano de representaciones de grupos, Valparaíso, Chile, January 5-9, 1998. (2 one-hour lectures)

19. American Mathematical Society Regional Meeting, (932), Kansas State University, Manhattan KS, March 27-28, 1998. (30 minutes)
20. Analyse harmonique sur le groupe $Sp(4)$, CIRM, Marseilles, France, June 15-19, 1998. (1 hour)
20. Cuatera taller de representaciones de grupos, Universidad Católica de Valparaíso, Chile and Universidad de Valparaíso, January 4-8, 1999. (3 one-hour lectures)
21. Workshop on representations of reductive p -adic groups, Centre de Recherches mathematiques, Université de Montreal, Montreal Canada, May 9-13, 1999. (1 hour)
22. Chicago State University, Jan. 31, 2000. (1 hour)
23. Northeastern Illinois University, Mathematics Colloquium, Feb. 2, 2000. (1 hour)
24. University of Chicago, Representation Theory Seminar, Feb. 3, 2000. (1 hour)
25. Roosevelt University, Chicago, IL, Feb. 4, 2000. (1 hour)
26. Howard University, Undergraduate Mathematics Colloquium, Feb. 22, 2000. (1 hour)
27. University of Maryland, Representation Theory Seminary, Feb. 23, 2000. (1 hour)
28. University of Maryland, Pi Mu Epsilon Society, Feb. 23, 2000. (1 hour)
29. Morgan State University, Department of Mathematics Colloquium, Feb. 24, 2000. (1 hour)
30. Howard University, Department of Mathematics Colloquium, Feb. 25, 2000. (1 hour)
31. Sexto Talleres de representaciones de grupos, Valparaiso, Chile, January 8-12, 2001. (4 one-hour lectures)
32. Florida State University, Undergraduate Mathematics Society, February 22, 2001. (1 hour)
33. Florida A&M University, Dept. of Mathematics Colloquium February 23, 2001. (1 hour)
34. Representations of Reductive p -adic groups, Pacific Inst. of Math. Sci., Feb. 20-24, 2002. (1 hour)
35. University of Michigan, Lie Groups Seminar, March 18, 2002. (1 hour)
36. University of Michigan, Undergraduate Seminar, March 19, 2002. (1 hour)

INVITED ADDRESSES (CONT.)

37. University of Minnesota, Automorphic Forms Seminar, April 11, 2002. (1 hour)
38. Recent progress in Langlands functoriality, CIRM, Luminy, France, June 17-28, 2002. (30 minutes)
39. IAS/Park City, Mathematics Institute, Park City, UT, June 30-July 20, 2002. (40 minutes)
40. International Workshop on K-types for p -adic reductive groups, Muenster, Germany, June 9-14, 2003. (1 hour)
41. University of Akron Department of Pure and Applied Mathematics Colloquium, March 9, 2004. (1 hour)
42. American Mathematical Society Regional Meeting, Northwestern University, Evanston, IL, October 22-23, 2004. (20 minutes)
43. University of East Anglia, School of Mathematics, Colloquium, July 14, 2005. (1 hour)
44. Recent Trends in Endoscopy and Representation Theory, Oct. 17-22, 2005, HumboldtUniversität zu Berlin. (1 hour)
45. Boston University Algebra Seminar, January 30, 2006 (1 hour)
46. Representation theory of p -adic groups, Kings College, London June 6-8, 2007 (1 hour)
47. On Certain L -functions, West Lafayette, IN July 30-August 3, 2007 (1 hour)
48. Generalizing Theta Correspondences, American Institute of Mathematics, Palo Alto, CA, July 28-August 1, 2008 (2 hours)
49. American Mathematical Society Midwest Regional Meeting, Western Michigan University, Kalamazoo, MI, Oct. 17-19, 2008 (20 minutes)
50. University of Chicago Representation Theory Seminar, Chicago, IL Oct. 28, 2008, (1 hour)
51. Univ. Blaise Pascal, Clermont-Ferrand, France, Department of Mathematics Colloquium, June 9, 2009 (1 hour)
52. Univ. Blaise Pascal, Clermont-Ferrand, France, Number Theory Seminar, June 18, 2009 (1 hour)

INVITED ADDRESSES (CONT.)

53. Midwest Conference on Automorphic Forms, Representation Theory, and Number Theory, University of Iowa, Iowa City, IA, Oct. 24-24, 2009 1 hour
54. University of Oklahoma-Oklahoma State Joint Automorphic Forms Seminar, Stillwater, OK, December 8, 2010 (2 hours)
56. Karcher Colloquium, University of Oklahoma, Norman OK, December 9, 2010 (1 hour)
57. University of Oklahoma Mathematics Club, Norman, OK, December 10, 2010 (1 hour)
58. Southern Illinois University Department of Mathematics Colloquium, Carbondale IL, April 14, 2011 (1 hour)
59. Southern Illinois University Automorphic Forms Seminar, Carbondale IL, April 14, 2011
60. Collaborative Number Theory Seminar at the CUNY Graduate Center, New York, NY, October 19, 2012 (1.5 hours)
61. Department of Mathematics Colloquium, Wabash College, Crawfordsville, IN, January 15, 2013 (1 hour)
62. Arizona State University, Tempe, Undergraduate Mathematics Club, Nov. 1, 2013 (1 hour)
63. Joint Mathematical Meetings, Baltimore, MD, Jan 15-18, 2014 (20 minutes)
64. Southern Illinois University, Carbondale, IL, Department Colloquium, March 27, 2014 (1 hour)
65. Arizona State University, Tempe, Undergraduate Mathematics Club, Nov. 6, 2014 (1 hour)
66. Institute of Mathematical Sciences, Chinese University of Hong Kong, Hong Kong, March 11-19, 2015 (4 lectures, 5 ½ hours total)
67. Southern University of New Orleans, Undergraduate Mathematics Majors, April 29, 2015 (1 hour)
68. 2015 Workshop in Number Theory, Morningside Center of Mathematics, Chinese Academy of Sciences, July 18-25, 2015 (2 lectures, 1 hour each)
69. Xavier University of New Orleans, Undergraduate Mathematics Club, Nov. 5, 2015 (1 hour)

INVITED ADDRESSES (CONT.)

70. Southern Illinois Mathematics Conference, Carbondale, IL, May 16, 2016 (30 Minutes)
71. Conference on Geometry, Algebra, Number Theory, and their Information technology Applications (GANITA), Fields Institute, University of Toronto, Toronto, ON, Canada, June 13-16, 2016 (20 minutes).
72. Ohio State University Special Colloquium, “Broadening Participation in STEM Through Mentoring: The National Alliance as a Model”, April 18, 2017 (1 hour)
73. Ohio State University Representation Theory Seminar, April 19 2017 (1 hour)
74. Ohio State University Radical Pi Undergraduate Mathematics Club, April 19, 2017 (1 hour)
75. Collaborative Number Theory Seminar at the CUNY Graduate Center, New York, NY, May 12, 2017 (1.5 hours)
76. NYC Math Sciences Alliance, City College of New York, May 13, 2017 (20 minutes)
77. Jiangsu Normal University Department of Mathematics Colloquium, Xuzhou China, March 12, 2018 (1 hour)
78. Jiangsu Normal University Number Theory Seminar, Xuzhou, China, March 19 & 21, 2018 (2 one-hour lectures)
79. Notre Dame University Representation Theory Seminar, South Bend, IN, September 10 2018, (1 hour)
80. NYC Math Sciences Alliance Conference, plenary speaker, September 15, 2018 (1 hour).
81. AMS Central Sectional Meeting, Ann Arbor, MI October 20-21, 2018, (45 minutes)
82. Invited Session, “Building Successful Communities in Mathematics”, Joint Mathematics Meetings, Baltimore, MD, January, 2019, (20 Minutes)
83. Sloan Indigenous Graduate Partnership Workshop, “Strategies to Attract and Support URM Graduate Students”, April 5, 2019, Purdue University (1 hour)
84. Joint Statistics Meetings, American Statistical Association Board Meeting, Denver, CO July 27, 2019 (30 minutes)
85. Joint Statistics Chairs Meeting, Denver, CO, July 28, 2019 (15 minutes)

INVITED ADDRESSES (CONT.)

86. Arizona State University, Department Colloquium, January 27, 2020 (1 hour)
87. Southern University A&M University, Baton Rouge, LA, Quality Education Program, February 14, 2020 (1 hour)

GRANT SUPPORT

1. June 1992 – May 1995; NSF Postdoctoral Fellowship, “Reducibility of induced representations for classical p -adic groups,” \$75,000.
2. June 1995 – May 1998; NSF Career Grant, “Intertwining operators, R -groups, and automorphic L -functions,” \$55,000.
3. August 1, 1998 – July 31, 2001; NSF Grant, “Intertwining operators, Plancherel measures, and automorphic L -functions,” \$79,341.
4. April 1, 2002 – March 31, 2003; NSF conference grant, “Recent Progress in Langlands Functoriality,” \$15,000.
5. July 1, 2004 – June 30, 2007; NSF Grant, “Extending the Langlands-Shahidi Program to the non-generic spectrum and related topics,” \$120,000.
6. June 1, 2007 – December 31, 2007, NSF conference grant, “On Certain L -functions”, \$30,000, also supported by \$8,000 from Clay Mathematics Institute, \$4,000 from Institute for Mathematics and Applications, and \$4,000 from the Number Theory Foundation.
7. August 16, 2010-August 15 2012, Department of Education GAANN Grant, “Increasing U.S. Doctorates in Mathematics”, (Co- Project Director, R. Bañuelos Project Director), \$522,624
8. Simons Foundation Collaboration Grants for Mathematicians, “ R -groups and L -functions for quasi-split groups and related problems”, September 1, 2013-August 31, 2018, \$35,000
9. NSF Conference Grant: “2014 Midwest Representation Theory Conference in Honor of Rebecca A. Herb’s 65th Birthday and in Memory of Paul J. Sally, Jr. “(co-PI with S. Weinberger, U. Chicago and S. DeBacker, U. Michigan) August 1, 2014-December 31, 2014, \$38,340
10. September 1, 2015- August 31, 2018, U. S. Department of Education, GAANN Grant, “Increasing U.S. Doctorates in Mathematics” (Project Director, G. Buzzard and R. Bañuelos co-PDs), \$885, 834.

GRANT SUPPORT (CONT.)

11. NSF Conference Grant: “2015 Midwest Representation Theory Conference” (PI, S. Takeda, co-PI), November 1, 2016-October 31, 2017, \$36, 282.
12. NSF Conference Grant: “The 2016 Paul J. Sally, Jr. Midwest Representation Theory Conference”, (co-PI, M. Krishnamurthy PI), October 1, 2017-September 30, 2017, \$13, 880
13. NSF Conference Grant: “2016 Field of Dreams Meeting” (PI, Edray Goins co-PI), December 1, 2016-November 30, 2017, \$30,000.
14. NSF Conference Grant: “2017 Field of Dreams Meeting” (PI, Edray Goins co-PI), \$49,500
15. NSA, “Field of Dreams Conference 2018 and 2019”, \$50,000, July 1, 2018- June 30, 2020
16. NSF Conference Grant: 2018 Field of Dreams Conference”, \$49,500 September 1, 2018-August 31, 2019
17. NSF Conference Grant: 2019 Field of Dreams Conference”, \$50,000 August 1, 2019-July 31, 2020

PENDING

19. NSF Conference Grant: 2019 Field of Dreams Conference”, \$300,000 August 1, 2020-July 31, 2022 , co-PI, Daniel Spirn, PI

CONFERENCES ORGANIZED

1. “Recent Progress in Langlands functoriality”, June 17-28, CIRM, Luminy, France
2. “On Certain L-functions”, in honor of Freydoon Shahidi’s 60th birthday, July 30-August 2007, Purdue University, West Lafayette, IN
3. “2014 Midwest Representation Theory Conference” in honor of R.A. Herb’s 65th birthday, and in memory of P.J. Sally, Jr., September 5-7, 2014, University of Chicago, Chicago, IL
4. “2015 Paul J. Sally, Jr. Midwest Representation Theory Conference”, November 11-13, 2015, University of Missouri, Columbia, MO
5. “2016 Paul J. Sally, Jr. Midwest Representation Theory Conference”, October 14-16, 2016, University of Iowa, Iowa City, IA

CONFERENCES ORGANIZED (CONT.)

6. 2016 Field of Dreams Conference, November 4-6, 2016, St. Louis, MO
7. “NYC Math Sciences Alliance”, May 13, 2017, City College, New York, NY
8. “2017 Paul J. Sally, Jr. Midwest Representation Theory Conference”, October 20-22, 2017, Purdue University, West Lafayette, IN
9. “2017 Field of Dreams Conference, November 3-5, 2017, St. Louis, MO
10. Special session, “If you build it they will come: Presentations by Scholars in the National Alliance for Doctoral Studies in the Mathematical Sciences” Joint Mathematics Meetings, San Diego CA, January 12, 2018
11. “2018 Gulf States Math Alliance Conference”, February 23-25, 2018, Tulane University, New Orleans, LA
12. “2018 Field of Dreams Conference”, November 2-4, 2018, St. Louis, MO
13. Special session, “If you build it they will come: Presentations by Scholars in the National Alliance for Doctoral Studies in the Mathematical Sciences” Joint Mathematics Meetings, Baltimore, MD, January 18, 2019
14. Career Paths in the Mathematical Sciences: An IMA/Math Alliance Workshop, Institute for Mathematics and its Applications, University of Minnesota, Minneapolis, MN, June 6-8, 2019
15. Session at Joint Statistical Meetings, “Becoming an Alliance Graduate Program Group”, Denver CO, July 27-August 1, 2019
16. “2018 Field of Dreams Conference”, November 15-17, 2019, St. Louis, MO
17. Special session, “If you build it they will come: Presentations by Scholars in the National Alliance for Doctoral Studies in the Mathematical Sciences” Joint Mathematics Meetings, Denver, CO, January 15 2020
18. Career Paths in the Mathematical Sciences: An IMA/Math Alliance Workshop, Institute for Mathematics and its Applications, University of Minnesota, Minneapolis, MN, June 4-6, 2020
19. “2020 Field of Dreams Conference”, November 6-8, 2020, Institute for Mathematics and its Applications, University of Minnesota, Minneapolis, MN

DEPARTMENTAL SERVICE

Computer Committee, 1995-99, 2002-2014
Computer Instructional Committee, 1995
Undergraduate Committee, 1997-2007
GAANN Proposal, 1999, 2009, and 2010
Head Review Committee, 2000
Director for Computational Instruction, 2000-2006
GAANN-VIGRE Committee, 2000-01
Elementary Service Committee, 2001-2005
Scholarship Committee Chairman, 2004-05
Promotions Committee, 2005-06, 2009-10, 2016-17
Graduate Committee 2007-2008 2013- (Chair)
RTG Proposal submitted 06/09, 6/10

DEPARTMENTAL SERVICE (CONT)

Recruiting Committee (Chair) 2010-2012
GAANN program Co-Director (2010-2015) and Director (2015- Associate
Head for Graduate Studies January 2013- July 2019
Department of Mathematics Diversity Committee

College Committees

Minority Affairs Committee 1995-96
Faculty Committee on Diversity 2007- (Chair 2008-2011)
Diversity Pillar Committee 2008
GCAP 2013- (Chair 2015-16)
Strategic Planning Graduate and Postdoctoral Education Workgroup (2015-16)

OTHER PROFESSIONAL SERVICE

External Reviewer, Southern University at New Orleans Department of Mathematics, April 29,
2019