Proposal for 2020 Mayterm/Summer Off-Campus Programs:
Mathematics / Computer Science / Data Analytics Majors
Maria (Maryke) van der Walt

Title: Encounters with Numbers and South Africans

Focus: The goal of this program is two-fold: students will be introduced to Numerical Mathematics by a world-renowned researcher in the field, and they will study South African history while being immersed in its culture. These goals will be achieved through lectures and computer labs at Stellenbosch University (my alma mater) and outings in and around the Stellenbosch and Cape Town area (where I grew up).

Student participants: The proposed program is aimed primarily at students majoring in Mathematics, Computer Science and Data Analytics. I am excited about expanding the study abroad offers for these majors.

Courses offered: I intend to offer two courses that will be taken by all the participating students:

- **CS/MA 150: Numerical Mathematics (4 units)**
  CS/MA 150 is a topics course currently in the Westmont Catalog, giving major credit for Mathematics, Computer Science and Data Analytics. I intend that the course will be co-taught by myself and Dr JAC Weideman (from Stellenbosch University). I attach a preliminary syllabus.

- **Reconciliation in South Africa (4 units)**
  The purpose of this course is to study South African history while being immersed in its culture. Specifically, we will focus on the history of racial injustice in South Africa and the progress that is being made towards reconciliation and peace among different ethnic groups. My hope is that this course will help students to see beyond themselves and their own experiences, and that this will help them to grow in love towards people unlike them and towards our Savior who calls to Himself peoples of all tribes and nations. I attach a preliminary syllabus.

Faculty:

- The program will be led by myself.
- I intend that Dr JAC Weideman from Stellenbosch University and I will co-teach the course CS/MA 150. Dr Weideman is a world-renowned researcher in the area of Numerical Analysis. He was recently elected as a Fellow of the Society of Industrial and Applied Mathematics (SIAM), one of the world's leading organizations in the field of Applied Mathematics. I attach his curriculum vitae.

Preliminary itinerary:

- **Week 1: Monday June 1 – Friday June 5**
  On campus (12 hours of class time)

- **Weeks 2 – 4: Monday June 8 – Friday June 26**
  South Africa
  - Travel to Cape Town, South Africa on June 8.
  - We will be stationed in Stellenbosch (about 30 miles from Cape Town) while we are in South Africa.
– Classes and computer labs for CS/MA 150 will be held at Stellenbosch University. I plan to arrange accommodation that is within walking distance of the university.

– For the Reconciliation in South Africa course, I plan several outings in the Cape Town area, including Robben Island, tours of Langa and Gugulethu (local townships), District Six Museum and Iziko Slave Lodge. I also plan meetings with students and local residents of Stellenbosch and guest lectures by local church leaders and faculty of Stellenbosch University. For outings to Cape Town, students will travel by bus.


Budget: Note: I am working with a dollar/rand exchange rate of R12 to $1. This is fairly conservative; the average rate for the last three years was R13.75.

- Faculty compensation:
  Assistant professor: $1587 × 4 units = $6348
  Professor: $1820 × 4 units = $7280
  Guest lectures by church leaders and Stellenbosch University faculty for the Reconciliation in South Africa course: $200 × 3 = $600
  Guest lectures by Stellenbosch University faculty for CS/MA 150: $200 × 4 = $800
  There are a few experts in Data Science on the faculty at the Applied Mathematics department of Stellenbosch University, and I would like to take advantage of this opportunity to give our students exposure to current research activities in this area.

- Accommodation:
  $100 per person × 18 nights = $1800 per person

- Meals:
  $40 per person × 18 days = $720 per person

- Bus and driver for transportation between Stellenbosch and Cape Town:
  $300 × 7 days = $2100

- Rental car:
  $1000 all-inclusive

- Renting facilities from Stellenbosch University:
  $50 × 13 days = $650

- MATLAB license for the course CS/MA 150:
  $49 per person

- Activity expenses for the Reconciliation in South Africa course:
  Robben Island: $30 per person
  Tour of Langa and Gugulethu: $25 per person
  Tour of Iziko Slave Lodge: $5 per person
  District Six Museum: $5 per person

- Tourist activity expenses:
  Table Mountain: $30 per person
  Aquila Game Reserve: $250 per person

- Administrative stipend:
  I will be taking care of administrative duties myself.
  1-10 students: $3000; 11-20 students: $4000
In summary, the group expenses add up to $21778 for 1-10 students and $22778 for 11-20 students, and the per-person expenses add up to $2914 per person. Therefore:

- With 8 students going, the total expense per student is $5636.25.
- With 10 students going, the total expense per student is $5091.80.
- With 12 students going, the total expense per student is $4812.17.
- With 14 students going, the total expense per student is $4541.
- With 16 students going, the total expense per student is $4337.63.

Accompanying family members: I plan that my husband and daughter (who will be 18 months old in mid-2020) will accompany me.
**CS/MA-150: Numerical Mathematics**

**June 2020**

**Instructors:** Dr Maryke van der Walt and Dr Andre Weideman

**Meeting times:** 12 hours per week

**Catalog Description:** (4 credit hours) Prerequisite: MA-010 and MA-020. Programming experience is desirable but not essential. MA-150: Course content will be determined by student interest and need. CS-150: Special courses offered on selected advanced topics in computer science. Content as announced. May be repeated for credit in a different topic. Counts toward major credit for B.S. in Computer Science, Data Analytics or Mathematics and B.A. in Computer Science and Mathematics.

**Overview and Objectives:** The purpose of this course is to study a number of computer methods for solving mathematical problems that would be difficult (or even impossible) to solve analytically.

The topics covered include: finite precision arithmetic, rounding error and stability, solving nonlinear equations numerically, solving linear systems numerically, interpolation using polynomials and cubic splines, numerical integration and numerical solution of differential equations. Students will use MATLAB (one of the standard languages used by applied mathematicians) to implement these methods.

The course will be co-taught by Dr van der Walt (Westmont) and Dr Weideman (Stellenbosch University). Dr Weideman is a world-renowned researcher in the area of Numerical Analysis. He was recently elected as a Fellow of the Society of Industrial and Applied Mathematics (SIAM), one of the world’s leading organizations in the field of Applied Mathematics.

**Course Learning Outcomes:** Formally, the course objectives described above can be summarized in the following course learning outcomes: By the end of this course, students should be able to:

(i) demonstrate mastery of the fundamental concepts as listed in the Overview and Objectives above;

(ii) use their mathematical knowledge to describe phenomena and solve problems encountered in the world around them;

(iii) display logical reasoning when faced with non-routine problems;

(iv) present sound mathematical arguments, both verbally and in written form;

(v) incorporate their mathematical skills and knowledge into their thinking about the Triune God and their identities as followers of Christ.

These outcomes will be assessed through written and computer assignments and exams.

**Program Learning Outcomes:** The course learning outcomes described above reflect the program learning outcomes formulated by the Mathematics department at Westmont College:

(1) Core Knowledge: Students will demonstrate knowledge of the main concepts, skills, and facts of the discipline of mathematics – reflected in (i).

(2) Communication: Students will be able to communicate mathematical ideas following the standard conventions of writing or speaking in the discipline – reflected in (iv).
(3) Creativity: Students will demonstrate the ability to formulate and make progress toward solving non-routine problems – reflected in (ii) and (iii).

(4) Christian Connection: Students will incorporate their mathematical skills and knowledge into their thinking about their vocations as followers of Christ – reflected in (v).


**Tentative Schedule:**

**Week 1 (Westmont)**
- Introduction to MATLAB
- Finite precision arithmetic, rounding error and stability
- Solving linear systems numerically

**Monday June 8**
- Travel to Cape Town, South Africa

**Week 2 (South Africa)**
- Solving nonlinear equations numerically
- Interpolation using polynomials and cubic splines

**Week 3 (South Africa)**
- Numerical integration

**Week 4 (South Africa)**
- Numerical solution of differential equations

**Friday June 26**
- Return to US

**Assignments:** Every week, you will complete an assignment consisting of exercises in hand-calculation, problem-solving and computer implementation. You are more than welcome to collaborate with your classmates on these assignments, as long as you write and turn in your own set of solutions and list the names of your collaborators on your solutions.

**Tests:** We will have two written tests in class.

**Grading:** Your grade will be calculated as follows:
- Assignments: 34%
- Two tests: 33% each

I will assign grades on the usual 90/80/70/60 scale; plus and minus grades will be assigned as appropriate. In borderline cases, I reserve the right to take into account consistency of attendance and participation.

**Attendance:** If you miss a significant number of classes, you will almost certainly do poorly in this class. If you miss more than six classes without a valid excuse, I reserve the right to terminate you from the course with a grade of F – this is in line with Westmont’s attendance policy, which is available at [http://www.westmont.edu/_offices/registrar/academic_policies/attendance-policies.html](http://www.westmont.edu/_offices/registrar/academic_policies/attendance-policies.html). Students are responsible for obtaining information and assignments distributed during missed classes. Class notes for missed days should be obtained from a fellow student and not the instructor.

**Academic Integrity:** Dishonesty of any kind may result in loss of credit for the work involved and the filing of a report with the Provost’s Office. Major or repeated infractions may result in dismissal from the course with a grade of F. Westmont’s plagiarism policy is available at [https://westmont.edu/_offices/provost/Plagiarism/policydoc.pdf](https://westmont.edu/_offices/provost/Plagiarism/policydoc.pdf).
Accommodation Procedure: Students who have been diagnosed with a disability (learning, physical or psychological) are strongly encouraged to contact the Disability Services office as early as possible to discuss appropriate accommodations for this course. Formal accommodations will only be granted for students whose disabilities have been verified by the Disability Services office. These accommodations may be necessary to ensure your equal access to this course. Please contact Sheri Noble, Director of Disability Services (310A Voskuyl Library, 805-565-6186, snoble@westmont.edu) or visit http://www.westmont.edu/_offices/disability/.
Overview and Objectives: (4 credit hours) The purpose of this course is to study South African history while being immersed in its culture. Specifically, we will focus on the history of racial injustice in South Africa and the progress that is being made towards reconciliation and peace among different ethnic groups. My hope is that this course will help students to see beyond themselves and their own experiences, and that this will help them to grow in love towards people unlike them and towards our Savior who calls to Himself peoples of all tribes and nations.

Course Learning Outcomes: Formally, the course objectives described above can be summarized in the following course learning outcomes: By the end of this course, students should be able to:

(i) understand the history of racial injustice in South Africa;

(ii) describe some of the progress that is being made towards reconciliation in South Africa;

(iii) reflect upon how their observation of racial injustice and reconciliation in South Africa shapes their own world view;

(iv) incorporate their observations and reflections into their thinking about the Triune God and their identities as followers of Christ.

These outcomes will be assessed through written assignments and group discussions.

General Education: This course fulfills the General Education requirement Thinking Globally because it emphasizes understanding of different world contexts and interaction with people of different cultures and ethnicities. It also fulfills the General Education requirement Understanding Society because it emphasizes understanding of the interplay among different groups and institutions in society.

Text:

- *Apartheid in South Africa: A Brief History with Documents* by David M. Gordon.

Planned Group Activities: Students will engage in the following activities while in South Africa:

- Tour Robben Island:
  Visit the site where Nelson Mandela, the first president of South Africa elected in a fully representative democratic election, was incarcerated for 18 years.
• Tour District Six Museum:
  District Six was a neighborhood designated for non-whites during the Apartheid regime.

• Tour Iziko Slave Lodge:
  A museum that explores the history of slavery in South Africa.

• Tour Langa and Gugulethu:
  A local resident act as tour guide of two townships in Cape Town.

• Visit Funda Fundisa:
  Interact with students from a Stellenbosch University campus club that provides tutoring services to high school students from a local township.

• Visit Libertas Choir:
  Interact with members of a choir that was established in 1988 with the mission of fostering harmonious co-existence between the respective cultural communities in South Africa through choral music, as reflected in the choir’s membership.

• Attend guest lectures by church leaders and faculty from Stellenbosch University.

**Tentative Schedule:**

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<tr>
<th>Week 1 (Westmont)</th>
<th>Introductory discussions</th>
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<tr>
<td><strong>Monday June 8</strong></td>
<td><strong>Travel to Cape Town, South Africa</strong></td>
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<tr>
<td>Week 2 (South Africa)</td>
<td>Tour of Robben Island</td>
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<td>Meeting students from Funda Fundisa</td>
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<td>Guest lecture</td>
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<td>Discussions</td>
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<tr>
<td>Week 3 (South Africa)</td>
<td>Tours of Iziko Slave Lodge and District Six Museum</td>
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<td>Guest lecture</td>
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<td>Discussions</td>
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<tr>
<td>Week 4 (South Africa)</td>
<td>Tour of Langa and Gugulethu</td>
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<td></td>
<td>Attend a rehearsal of Libertas Choir</td>
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<td>Guest lecture</td>
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<tr>
<td><strong>Friday June 26</strong></td>
<td><strong>Return to US</strong></td>
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**Assignments:** Students will complete a number of written assignments in this course:

• Reading log:
  Short reflections / essays on the course texts.

• Activity log:
  Short reflections / essays on each of the planned group activities.

• Essay:
  A reflective essay composed at the end of our time in South Africa.
Grading: Grades will be calculated as follows:
- Participation and group discussions: 10%
- Reading log: 25%
- Activity log: 25%
- Essay: 40%

Academic Integrity: Dishonesty of any kind may result in loss of credit for the work involved and the filing of a report with the Provost’s Office. Major or repeated infractions may result in dismissal from the course with a grade of F. Westmont’s plagiarism policy is available at https://westmont.edu/_offices/provost/Plagiarism/policydoc.pdf.

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Curriculum Vitae: J.A.C Weideman

Updated March 2019

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Personal

Born: November 25, 1957, Bloemfontein, South Africa.

Marital Status: Married, three children.

Education

1978: B.Sc. (Mathematics and Applied Mathematics), University of the Orange Free State (UOFS), Bloemfontein, South Africa.

1979: B.Sc. Honns. (Applied Mathematics), UOFS.

1980: M.Sc. (Applied Mathematics), UOFS.


Employment

1980–89: Lecturer–Senior Lecturer, Department of Applied Mathematics, UOFS.

1986–87: Visiting Scholar, Massachusetts Institute of Technology, Cambridge, Mass., USA (on leave from UOFS).

1990–1994: Assistant Professor (tenure track), Department of Mathematics, Oregon State University, Corvallis OR, USA.

1995–1998: Associate Professor (with indefinite tenure), Department of Mathematics, Oregon State University, Corvallis OR, USA.

1996–1997: Visiting Associate Professor, Department of Computer Science, University of Utah, Salt Lake City (on leave from OSU).

1999–present: Professor, Department of Applied Mathematics, University of Stellenbosch, RSA.

Publications


2. JAC Weideman, “Annie@60: A life in approximation,” *Dolomite Research Notes in Approximation*, 10, pp. 1–5 (2017) (Summary of the invited plenary address delivered in honour of the 60th birthday celebrations of Professor Annie Cuyt (Antwerp).)


**Invited Keynote Presentations at Conferences**

1. Laplace Transform Methods and Their Applications, National Institute for Mathematical Sciences, Daejeon, Korea, October 2011
4. New Directions in Numerical Computing, Oxford University, England, August 2015
5. 4th Dolomite Conference on Constructive Approximation, Dolomite Research Centre, Alba di Canazei, Italy, September 2016

**Research Grants**

1. NSF Grant DMS-9404599 (USA), 1994–1996
2. Several NRF Grants (South Africa) 1999–current
3. British Royal Society award (support scheme for developing countries) 2006
4. London Mathematical Society travel award 2009

**Teaching & Postgraduate Supervision**

Only Stellenbosch University statistics listed here (not for earlier positions at OSU or the UFS):

Undergraduate Courses Taught: TW214 (Applied Linear Algebra), TW244 (Applied Differential Equations), TW324 (Numerical Methods), TW364 (Applied Fourier Analysis), TWB264 (Advanced Mathematical Methods for Engineers), NM262 (Numerical Methods for Engineers)

Postgraduate Courses Taught: TW781 (Analytical Methods of Applied Mathematics), TW776 (Numerical Methods), TW834 (Partial Differential Equations for Engineers)

Curriculum Development: TW364, TW781, TW776 (all three developed from scratch), and TWB264 (developed in collaboration with colleagues at Engineering and Applied Math).

MSc Students: Fernando Nieuwveldt, Gert Wessels (both completed 2008), Edgard Ngounda (completed 2009), Eyaya Eneyew (completed 2011), Chinenyre Assumpta Nnakenyi (AIMS, completed 2015), Gerhard Kirsten (completed 2018)

PhD Students: Marco Fasondini (externally supervised at the UFS, completed degree in 2018)


Service

3. Reviewer for top rated international journals (SIAM, IMA, Royal Society, ACM, etc.)
5. Reviewer for local and international grant agencies (NRF in SA, NSF in USA, Swiss NSF, Belgian FWO, French ISITE–BFC).
6. Consulted by appointment committees for senior level positions (USA, Canada, Korea).
7. Associate editor for Electronic Transactions in Numerical Analysis and Numerical Algorithms (international) and editorial board member for Quaestiones Mathematica (national).
8. Member of the SIAM\(^1\) committee on Committees and Appointments.

Miscellaneous Distinctions

5. Elected as Fellow of SIAM in 2017 (“For powerful and elegant algorithms derived from complex analysis.”)

In the Future

1. Invited speaker at the ICIAM\(^2\) meeting that will be held in July 2019 in Valencia, Spain.
2. Invited speaker at the 3rd BRICS\(^3\) meeting on Mathematics and Statistics to be held in July 2019 in Kazan, Russia.
3. One of five international co-organizers of a research programme “Complex Analysis: Techniques, Applications and Computations,” scheduled for September to December, 2019. This will be held at the Isaac Newton Institute for Mathematical Sciences in Cambridge, UK.

\(^{1}\)SIAM = Society for Industrial and Applied Mathematics
\(^{2}\)ICIAM = International Congress of Industrial and Applied Mathematics
\(^{3}\)BRICS = Brazil, Russia, India, China, South Africa