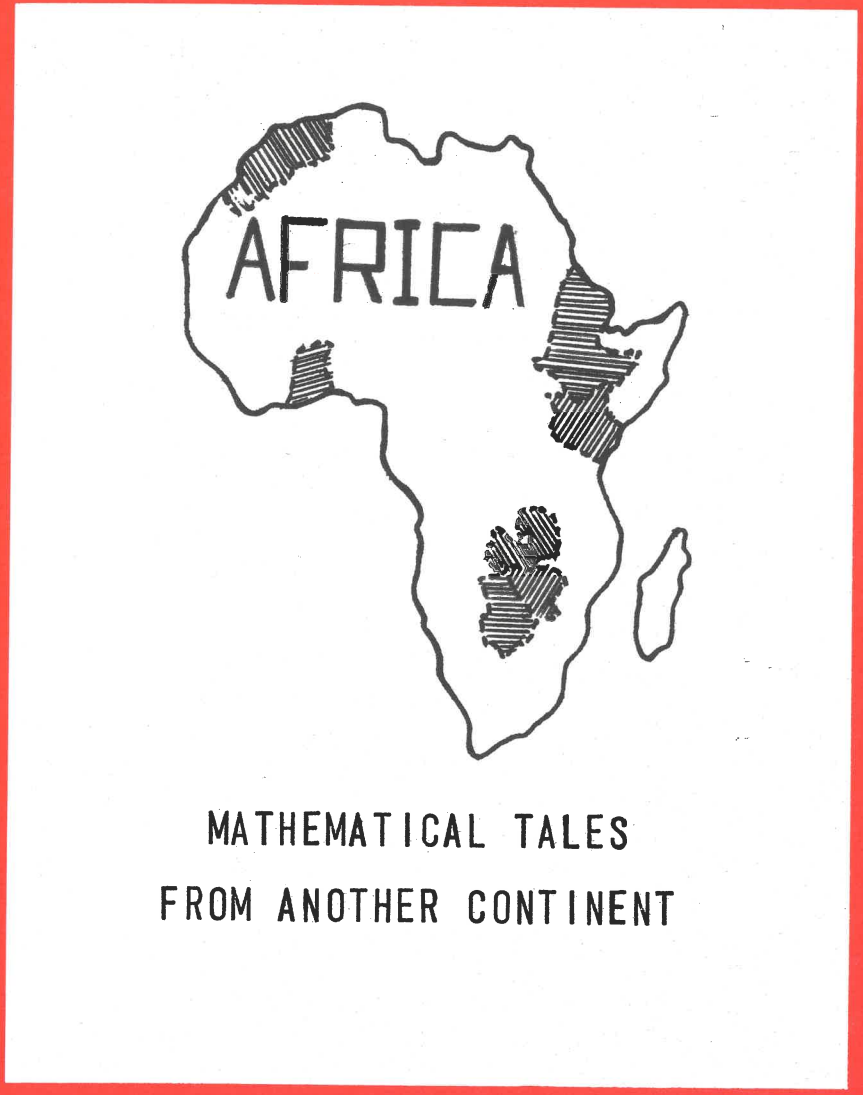
QUEEN'S MATHEMATICAL COMMUNICATOR



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MARCH 1983

The Mathematical Communicator is a magazine for the alumni(ae) of the Department of Mathematics and Statistics at Queen's. We welcome comments, problems, solutions, news letters, and even articles, from this constituency. Please address all correspondence to:

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Please let us know if you change your address .

Peter Taylor
Editor

MATHEMATICS IN AFRICA

One way or another the Mathematics & Statistics Department at Queen's has had considerable contact with Africa. As a change of pace we thought it might be of interest to present, in this issue of the Communicator, a collection of insights and comments from those of us who have visited or worked in that great continent. Our contributors include Canadians who have visited Africa and Africans who are visiting Canada. They are:

Enoch BORTEY Born in Ghana in 1954, he obtained his B.Sc. at the University of Science and Technology in Kumasi, Ghana in 1980. He is currently doing an M.Sc. in Statistics at Queen's.

John COLEMAN is well-known by virtually all our readers because his tenure as Head of the Department of Mathematics and Statistics at Queen's has spanned the last two decades. [Communicator, April 1980] He has travelled widely - first as Universities Secretary of WSCF (1940-43) then as Chairman of the Exchange Commission of the International Mathematics Union. Most recently (last summer) he visted China, Hong Kong, Singapore, Madras and, for the second time, Morocco.

Driss ESSELAOUI born in Fes, Morocco in 1953, did his undergraduate work at University Mohamed V in Rabat. He obtained his Doctorat in Numerical Analysis in Paris in 1979, and is now Professor at Mohamed V. He was a visitor to Queen's last fall.

Bill HIGGINSON is an Associate Professor at Queen's in Mathematics Education. He was a Queen's graduate (Arts 1965) and somewhere in the midst of his subsequent years of study at Cambridge and high school teaching at Toronto, obtained a Ph.D. from Edmonton. His current research interests concern the computer in (or better out of?) the classroom. He is particularly keen on LOGO.

Ian HUGHES is an Associate Professor at Queen's. He was born in South Africa and obtained his degrees at Witwatersrand and Oxford. Currently he is on leave for two years at the University of Nairobi, although he is, in fact, at Queen's. Read his article to see why.

Tamuka KASEKE was born in Zimbabwe in 1958. He did his undergraduate work at the University of Zimbabwe and the University of the West Indies. In 1981 he worked as a government statistician in Zimbabwe. At present he is doing an M.Sc. at Queen's under Lorne Campbell. He plans to return to Zimbabwe.

Abdelhag NADIRE born in Morocco in 1956, did his undergraduate work at University Mohamed V in Rabat in Mathematics and Physics. He then went to France to study at Montpellier and Perpignon, obtaining his Doctorat of the 3rd Cycle in 1981. Last year he lectured at Mohamed V. He has spent Fall '82 at Queen's.

Fassil NEBEBE is working towards a Ph.D. in Statistics at Queen's. He was born in Ethiopia and obtained B.Sc. at Addis Ababa, and M.Sc. at Southampton, U.K. When finished he hopes to return home and work at Addis Ababa University.

Ali SOUISSI born in Morocco in 1953, did his undergraduate work at University Mohamed V in Rabat in pure mathematics. He then studied numerical analysis in Paris and obtained his Doctorat in PDE's at Rennes, France in 1979. He is now at Mohamed V and his interests are in optimal control theory. He was at Queen's last fall as a visitor.

Jim WHITLEY is an Associate Professor at Queen's. He is a fierce Irishman and was schooled at the Royal Academy and Queen's University, Belfast. He returned this year from four years in Botswana under the auspices of the Canadian International Development Agency. His interests are in mathematics education.

Dick WILLMOTT is an Associate Professor at Queen's. He was actually born in China (where his father was a missionary), and he obtained his degrees in Mathematics from Swarthmore, Princeton, and U.B.C. He taught at the University of Zambia from 1973-75. At present he is Chairman of Undergraduate Studies in the Department of Mathematics and Statistics.

MOROCCO

Struggling Toward A
Modern University System

From John Coleman

Almost any aseptic North American who visits Fez for the first time catches dysentery. I was no exception. It lasted about one month. Only the dysentery that I contracted in Turkey in 1953, a few days before my marriage, was more severe. Even so, here I am writing about my experience so I must have survived. Scribo ergo sum as Descartes would certainly have remarked if he had visited Morocco.

During my first visit to Morocco, in 1976 to attend the African Mathematical Congress, I stayed in the capital, Rabat, and did not go to the famous ancient city of Fez which is celebrated because the MEDINA of Fez -- that is the old walled city -- is widely regarded as the most perfectly preserved example of a Medieval city in the Arabic world. Professor Ribenboim had insisted that I must visit Fez becuase he had enjoyed it and because his student, Mustafa Genoun, is now the Head of the Department of Mathematics of the University of Fez.

Professor Genoun had been the first person to be awarded a Ph.D. in mathematics by a Moroccan university. Ribenboim was the external examiner and was present for the Thesis Defense. It was on that occasion that the idea had surfaced that Queen's and Rabat should enter into a mathematical partnership. My visit to Morocco in May, on my way back from three weeks in China, was viewed as the initiation of our Exchange.

During the six years between my two visits there have been great changes. In 1976 one saw many attractive girls dressed like the most elegant parisienne. But there were also a fair number of older veiled women who walked dutifully behind their husband. In 1982 there are more of the the former but fewer of the latter.

More important, there have been significant strides in education. The mathematics library of the University of Rabat has improved enormously though it is still a far cry from the library of Jeffery Hall. Several new universities and teacher's colleges have been established. In the latter there has been a programme during the past five years, partly financed by CIDA, which took a professor of education from Quebec to Morocco to train the teachers of teachers. This was so successful that it is now being phased out since the Moroccans can manage by themselves at that level.

In Fez a set of attractive builings designed by a French architect is nearing completion for the new university. However, symbolic of the physical situation in which our Moroccan colleagues work, is the fact that apart from Professor Genoun who has a small office of his own, the other 17 members of the faculty share <u>one</u> moderate size room and 12 chairs. Neither at Fez nor at Rabat do the mathematicians have access to any computer of significant power.

Any Canadian for whom a visit to Morocco was his first contact with Africa would be struck by the percentage of the national budget that is spent on the army. In nearly all African countries the government is legitimized by means of raw military force. When the Opposition in Morocco refused to participate in Parliament they were forced to return at gun-point! Society is organized from the top down. This applies to the university as to all social structures. The Dean of the Faculty has authority far exceeding that which his Canadian counterparts would yearn for in their wildest imaginings! The average Lecturers in a Canadian university would regard the lot of their colleagues in Morocco as quite intolerable and consider that they are treated as a form of slave labour! Even so, I was most favourably impressed by the number, ability and knowlege of the maîtres-assistant to whom I lectured. All of them have completed the 3rd Cycle in France and most of them would like to obtain a Ph.D. in Canada or the U.S.A.

From Ali Souissi
Driss Esselaoui

To talk about universities is to talk about the world of culture, science and technology. Universities have played, play, and will continue to play a crucial role in the development and progress of the world.

<u>The old</u>. El Karaoyine University in Fez, established is the oldest in the Arabic and Moslim world. It was primarily founded to teach Islam and Arabic literature, but its development, at many points, was stifled by colonialism, either Spanish or French. You could find in this university many philosophers and "Oulamas" (theologs) like Ibn Khaldown, Ibn Battouta and Ibn Elbanna (a mathematician of the 16th-17th century). Students came here from all over the Arab and Moslim world, and other African countries.

This university played a major role in the liberation of Morocco (1956). The ideas of independence began here and spread out to other cities and villages. El Karaoyine still exists but does not command the attention it once did. It still teaches in Arabic, literature and philosophy as before, but no science.

The new. The Mohamed V University of Rabat, established in the late 50's, just after independence is now the largest in the country.

Until the 60's, its suffered from a lack of instructors. We could find only French isntructors who copied the educational system from the French universities. At that time, we could not really talk about research being conducted there mainly because there were no local instructors and professors. We had to wait until the 60's to see young Moroccan graduates coming from France and ready to work. Then at last the university was able to grow, and other "satellite" universities were created which have an enormous potential for meeting the student demand.

Research is very diverse in the Moroccan universities. In the literary and medical domains, many papers are published locally and in international journals. That is due to the fact that these faculties are independent and have enough Moroccan researchers. This is not the case in the other faculties, in particular the Faculty of Science. Here, research is only at its beginning. Every department tries to get organized in order to create groups of researchers. In mathematics only pure research has been seen. Applied maths has just begun.

Applied research in all sciences requires equipment and facilities and these are in absurdly short supply. For example, in Mohamed V University there is only one small computer (a gift of Belgium) for the use of the Engineering school. In the Mathematics Department there are now some professors in applied mathematics and several Maitre-assistants, but no computer! Not only is it difficult to teach and do research, it is difficult to attract visitors in these areas to stimulate activity.

The university relies greatly on exchanges and collaboration with other countries. In addition to the exchange agreement with Queen's, the Institute of Statistics in Morocco has regular collaboration with the University of Montreal. We hope agreements of this sort may help us to get improved facilities for research and more visitors in applied fields.

From Abdelhaq Nadire

As is well known, there are many organizations which have put considerable effort into the development of education in third world countries.

It goes without saying that, at the present time, the use of the languages of a few developed countries in the field of the sciences creates problems involving lack of understanding of different civilizations, customs and languages.

The student is much more concerned with the meaning of words, sentences, idioms, etc., than with the scientific content in question. For example, in mathematics, the notions of "... at most countable", "there exists at least..." "the condition is necessary and sufficient..." are very difficult to grasp the first time they are presented.

As an example, a high school student who was asked "What happens when you hang two weights on a "poulie" (pulley in French), replied the "poulet" (chicken) dies.

The student cannot yet differentiate the word "poulie" from "poulet", the latter being much more familiar to him.

GHANA

The Tortoise and the Deer
From Enoch Bortey

Many years ago there lived a tortoise and a deer in a village called "no man's land". The name of the village is of course deceptive since it was located in the midst of the animal kingdom. However, one can make sense of the village's name when the intimate relationship between the deer and the tortoise is taken into account. They were literally bedfellows and did everything together.

One day, the King of the forest Mr. Lion decided to throw a party and invited all the members of the animal kingdom. Naturally every invited guest considered it as a very big honour to be asked by his majesty. As should be expected everyone tried to appear in his best outfit and Mr. Tortoise and Mr. Deer were not going to be left behind. The nature of the party was not disclosed but everyone of course expected it to be a time of merry making and relief from the perennial frustration with life in the animal kingdom.

The long awaited day of the Party arrived and wow! It was a beauty to see the members of the animal kingdom in their best outfits -- The rabbits in suits, elephants in coat-tails, squirrels in evening dress and three piece suits and lo and behold the tortoise and the deer in an immaculate double-breasted suit.

After much drinking and eating the host suggested that the whole evening be crowned with a dance. Everyone was exultant at the prospect with the exception of tortoise who was not particularly keen on dancing. Tortoise's bosom friend, Deer, was unequalled in his skillful footwork; the musicians especially the drummers were beating the drums as if they were possessed and in some kind of frenzy.

Well after a couple of dances deer invited his friend Tortoise to come and portray his dancing prowess but tortoise refused for his good friend's sake. Deer, however, would not relent and consistently badgered his friend pursuading him to the dance floor. The whole place was filled with laughter when Tortoise stepped on the floor -- no one had ever seen a Tortoise dance. After awhile the Deer suggested that tortoise had performed well and therefore should rest a bit but he would not be persuaded. It was soon rumoured that one of the drums had burst and when word came to the ears of Lion, his response was the nobody was in ignorance about the material used for covering drums and therefore since Deer was present they should just slaughter him and use his skin to cover the drum.

It was really tragic when the animals pounced on the deer and after several protestations he beckoned his friend tortoise to come to his succour but tortoise could not and would not because he had forwarned the deer of the possible consequences of his being forced to dance.

KENYA

Textbooks and Revolutions
From Ian Hughes

At the beginning of September 1981 I arrived in Kenya to take up a two year contract at the University of Nairobi. The academic year, which usually begins there in October, started late that year because the University has earlier been closed down for two months. In May a student demonstration and the subsequent disturbances had prompted the President of the country to order its closure.

The new academic year, therefore, was not to start until early December. This gave me the opportunity to organize a supply of text-books for the first year linear algebra course to which I had been assigned. Let me explain. Although a text-book is usually available for each course, only a few students do buy it since the majority of students cannot afford the cost. I contacted Professor Dick Willmott at Queen's who, together with graduate students Amar Sodhi and Anna Lorenzini, made an appeal to Queen's students to donate their used copies of Anton's Linear Algebra. The response was excellent and finally fifty-six copies were sent to Nairobi. They arrived in January, about three weeks after the beginning of term. The spirit of the operation was exemplified by a note one student here wrote in the front of his donated text: "Good luck! I hope this book is of use to you."

There are about one hundred and thirty students in the course which was divided into two sections: one taught by me and the other by Mr. Claudio Ackola, a Kenyan who specializes in Algebra and is using coding theory in a linguistic study of Swahili. Each of the fifty-six books was lent to a pair of students who gave us a one hundred shillings deposit, about twelve Canadian dollars. We opted to lend the books rather than sell them or give them to the students so that the books would be available for subsequent years. Having the books made an enormous difference to the students' understanding of the material and their performance in coursework. I also taught Calculus to the same group of students without the benefit of text-books and the level of performance was substantially different.

Until the beginning of August the year progressed without any major disruptions -- just a few minor crises occurred. Then in the early hours of Sunday morning August 18th members of the Kenya Air force staged a coup. They took over the radio-station (located near the University), a key building in any power struggle. Some Air Force people went to the university residences (all the students live there) and urged the students to go the city centre and celebrate the "revolution". Some students took to the streets, commandeered cars and buses and did indeed celebrate the coup.

However, the coup was put down by the Kenya Army in three hours. Some of these students were killed and others arrested. The next day the government closed down the University, the students were sent home, and I returned to Canada to join my family and await the re-opening of the University of Nairobi. A decision as to when this will happen has not yet been made.

So my students are at their homes, mostly in the rural areas of Kenya and I am in Kingston. I have their five thousand, six hundred shillings and they have fifty-six copies of Anton's Linear Algebra text!

I would be grateful to receive any undergraduate text-books, expecially first year calculus, linear algebra and statistics. Please send them to me at the Department of Mathematics and Statistics here at Queen's and I will send them on to Nairobi.

Memories of a Mathematical Missionary
From Bill Higginson

My all-male tenth-grade technical-mathematics class in Kingston reacted to the announcement of my plans to teach in Africa in an all too predictable fashion. The snicker-inducing note, when finally intercepted, read, "He must like his women like his coffee, hot and black". This conjecture, which was probably the closest thing to scientific thought that transpired in the class during the year was quite wrong. The reality of my motivation for wanting to work in Kenya under the auspices of the Canadian University Service Overseas was a complex amalgam of goodwill, naivete and curiosity. (In those days we called ourselves 'volunteers'; latterly CUSO's have styled themselves as 'cooperants'. Perhaps someone pointed out that one meaning of volunteer is "to be thrown from a horse without sufficient cause").

The first response to the news of my posting had not been encouraging either. As planned, I had raced to the room of my Kenyan friend at Queen's when I received the long-awaited telegram stating that I was to spend the next two years at Kabarnet School in the Baringo District. "Kabarnet", Frank had said, as his face fell, "That's the most remotest place in Kenya". In retrospect, it probably was one of the most-isolated schools in the nation, but it was an extremely pleasant place to work from the fall of 1966 to the summer of 1968.

Throughout that period I taught mathematics to all 140 boys in the single-stream government boarding school. For much of the time I also taught English and History and for shorter periods Biology, Current Affairs, General Science and Physcial Education. The boys disliked Current Affairs which was not a subject on which they were examined by the formidable Cambridge Overseas Examinations Syndicate. I didn't care much for the text's brand of History; the irony of teaching "the coming of the Europeans" was more than I could accept. Biology had its moments, most notably when my carefully set-up Form II mystery object turned out to be a chameleon, a beastie which I later found the boys believed affected one's virility adversely. One chap leapt out the window while the rest, muttering loudly, crowded into the back corner. English had its soggy bits. George Eliot and Arnold Bennett were two of the racier authors on the set literature syllabus and the grammatical side of things bristled with mysteries like syllepsis and zeugma. Essay marking had its lighter moments which made one more aware of the wonders of language; "I went for a walk by circling" (a few paragraphs later his 'circle' got stuck in the mud!), "the first white man I saw was a refrigerator" (invigilator) and my favourite closing line, "Hopping to read you soon".

Perhaps it was partly contrast, but teaching mathematics was a great pleasure. In the upper forms where the students were preparing for their external exams, the syllabus came straight from neo-Victorian times. The texts by Durcell of Winchester were of the Hall and Knight genre, heavily influenced by Euclid, substantial, stimulating and full of things like nine-point circles. Class difficulties frequently came not so much from the mathematics as from the context of the problems. A question about the locus of a point on the nose of a merry-go-round horse generated much discussion; not about loci, but about

merry-go-rounds. (The idea of muscial wooden nags simultaneously going up and down and round and round was met with a fair measure of skepticism.)

In Form I on the other hand, there was a pilot site for a very good 'new math' program, the East African School Mathematics Project written by some of the people who had worked on the British SMP series. Given that for most of the year I had 35 desks, 37 students and one textbook, one might have expected trouble. In fact, it was a very exciting intellectual experience. At that time students gained secondary school places on the basis of aggregate scores on three examinations at the end of elementary school. These selective and highly competitive examinations were in English, General Knowledge and Mathematics. Since generally, English was not well taught in the local area, boys gaining entrance to the school tended to be very strong in General Knowledge and Mathematics. (In over 15 years of teaching mathematics I have seldom seen students as able as those in Kenya).

I have no very vivid memories of 'informal' mathematics in East Africa, nor did I see much evidence of traditional African games such as Wari which I had read about. The one surprise I did have came from the game of checkers which the Kenyans played at great speed. They would be halfway through a game in the time it would take most North Americans to make a few moves.

ETHIOPEA

Poor Demand for Science Graduates
From Fassil Nebebe

Pre-university education in Ethiopea falls into into three broad levels: primary (grades 1 to 6), junior secondary (grades 7 to 9), and secondary education (grades 10 to 12). Higher education incorporates teacher training, technical, commercial and agricultural colleges, and two universities -- one of them small and the other very big. All institutions of learning share common characteristics: they have too many students and too few instructors, they are poorly budgeted, and all are run by the state.

Every year there are many qualified applicants for admission, much more than the colleges and universities can accommodate. The first of the four years at the universities in general in which students take two full semesters (16 weeks each) of intensive courses in mathematics, sciences, Ethiopean studies and political economy -- a recent phenomenon which has become a must for every student. Successful students after completion of the Freshman program go to join their areas of interest. Speciulization begins in the second year and is developed in the third and fourth years.

At all levels of education, mathematics and the other sciences are fairly uniformly represented in the curricula, and occupy predominant positions in the institutions of higher learning. Nevertheless, these fields are of low priority on a student's list of preferences of specialization, because of job prospects. A major source of employment for graduates is with the Ministry of Education for teaching at the secondary school level. There are openings but not many, in research centres and industries, for graduates in biology, chemistry and physics, but for pure mathematics graduates employment opportunities other than teaching in schools are rare.

10.

ZIMBABWE

Independence Brings Education Change

From Tamuka Kaseke

[The independence of Zimbabwe, in 1980, after 90 years of colonial rule, has opened the gate for enormous changes in the educational system. Such change, so quickly and so suddenly, has placed great stress on teachers and administrators (and perhaps even on students). But Tamuka Kaseke has great optimism for the long-term health of education in Zimbabwe. He describes some features of the old and new systems.]

The Colonial Period. Of course, the British system was used: secondary school terminated in "O" levels or, for those going on to university, "A" levels. Schools were segregated and many more resources (10 times as much per student in the Smith regime) were spent on European schools than on African schools. In the early 70's a minority of private schools were permitted to admit children of other races if parents and school governors so wished, but these were within reach (financially and geographically) of an insignificant fraction of African families.

Although education was supposedly compulsory, many African children did not attend for long. For example in 1976 over half of Zimbabwe's black population (6.4 million) were under 15 years of age, but only 1/4 of these were in primary school. Of these half would drop ot before completion. Of those who did graduate, 3% went on to secondary school and 0.1% reached 6th form. So when I did 6th form in 1976 there were only 3690 black students doing the same in the whole of Zimbabwe!

After Independence. Huge changes were made almost immediately to improve access. Already in 1981 (after one year) 90% of the school age population (6-16 years) were in schools. It is hard to get one's mind around a change of this magnitude (where have the teachers come from?) It represents one of the highest enrolment rates in developing countries. A "sandwich" type teacher training program was in fact introduced. It appears to be coping well, in spite of the enormous stresses and strains.

Of course, all the discriminatory regulations that were effected before independence have been scrapped. Schools that were reserved for a particular race are now open to all races in the country.

Zimbabweans place a lot of importance on education. This importance coupled with their desire to learn and their enthusiasm in the learning process, makes it a pleasure to teach in Zimbabwe. For the imaginative and dedicated professional, Zimbabwe's education system offers unmeasurable opportunities for experimentation and research.

ZAMBIA

Emphasis on General Education
From Dick Willmott

Mathematicians who go to an African country to teach can find themselves faced with practices different from those to which they are accustomed. Before I left in early 1973 to teach at the University of Zambia for two years, I received from them the 1973 Handbook of the School of Natural Sciences. Under section I (i), Requirements for the Degree of B.Sc. section (c) read, "Not more than six courses in any one subject except mathematics, for which the limit is seven". The origin and consequences of the policy resulting in this unusual upper bound are interesting.

The government believed the university should be "dedicated to the task of responding to the real needs of Zambia". The need for university educated people in a country which at independence nine years earlier had fewer than 100 citizens with degrees was not felt to extend to narrowly specialized academics, but to more generally educated graduates who could enter the primary and secondary education systems, state enterprises, government and industry. The Ministry of Education thus forbad any single subject majors in the B.Sc. or B.Sc. with Education programmes in the natural sciences.

A consequence of this restriction for the Mathematics Department was the lack of any honours courses or programme, or indeed, of any courses above the level of a few general third-year courses here. The resulting atmosphere did not foster research, and little was done in the department at that time. There was a programme by which one or two graduates a year were kept on for two years as "Staff Development Fellows", teaching perhaps one course and reading more advanced mathematics in preparation for possible graduate study abroad. Shortly before I left, the first such Zambian trained abroad joined the department.

After teaching and living in Zambia for those two years, I felt that that aspect of educational policy, although unusual from our point of view, was almost certainly in the best interests of the country.

BOTSWANA

School Mathematics - a student viewpoint

From Jim Whitley

During my four years in Botswana (1978-82) I was responsible for the creation and implementation of a mathematics programme to bridge the gap between Cambridge Overseas Certificate "O" level and University College of Botswana. Before the introduction of this programme, the failure rate in first year college mathematics was close to 100%. Now it has been reduced to an acceptable 25%.

Of the 14000 students who write secondary school entrance exams (after Grade 7) only about 120 are selected for university, and even of these, only about 35 can be considered university material. This cannot be interpreted as meaning that only 0.25% of Grade 7 leavers have the innate ability and aptitude necessary to reach the university level of education. Rather it is a reflection of the disastrous situation, which exists in all aspects and levels of education throughout the country.

A further complicating factor is the fact that the Botswana word for Mathematics is "Diphals", which, loosely translated means, "difficult stuff". Virtually all students in Botswana come from villages, where straight lines, parallel lines, rectangular buidlings and all the trappings of modern technology are almost non-existent. The mathematics of commerce has only recently evolved. As a result the Botswana language is almost entirely devoid of a mathematics-related vocabulary. Since the link between language and the thinking process has been well-established, it should be no surprise, then, that the teaching of Mathematics in Botswana presents enormous difficulties. The successful teacher, of which there are very few, must be constantly aware that, what he/she says or writes, however clearly, is not necessarily understood by the students.

As a result, the vast majority of students rely on rote-learning, encouraged by their teachers. For example, most Form V students can "solve triangles" using the sine rule or the cosine rule, one of the standard questions every year on the COSC mathematics examination, yet the students have no idea of the nature of the circular functions. They will happily "solve" impossible triangles simply by blindly following the procedure they have rehearsed ad nauseum. Most students can multiply (a+b) by (c+d) using the infamous "FOIL" rule but cannot handle (a+b)(c+d+e) . The main thrust of the PESC mathematics programme [Pre-Entry Science Course - a 6-month upgrading course for university entrance] is to eliminate this passive rote-learning attitude by developing an aggressive and confident approach to problem-solving. The success of this programme can be judged by the performance of students in examinations and by their written comments at the end of the course. Some of those comments are given below [unedited].

" Now that I learned a lot from the PESC math course I'm extremely happy, I have gained some confidence in myself because I discovered that I wasn't that much dullheaded in maths as I thought before, I even wish I could go back to Cambridge and show them teachers there that I'm not that much stupid in maths as they used to tell me because you see I'm no longer scared about being presented with a tough mathematical problem, I trust myself now, I would even trust myself more than ever in tougher conditions because the PESC maths course has bred a brave and gallant warrior out of me"

"I've taken some part of trigonometry in secondary school for instance I knew the Sine Rule, Cosine Rule and the Pythagoras theorem, but unfortunately I didn't even know that $\sin^2 A + \cos^2 A = 1$ even though I say I learned the Pythagoras theorem. To tell about how much I understood about these topics now, well, knowing about the above topics when I first came to PESC was like a soldier who was given weopans but did not know on earth what the hell he was supposed to doo with them, so that when he is attacked he just run away hopelessly, but now, having ran away and sought assyllum from the right persons the soldier has well been briefed and advised about the functions of the weapons he is carring, now he is confident again."

"I can even use my own method without fearing that I will be marked wrong. I am thinking of becoming a mathematician"

"I am now very happy that my understanding of Mathematics has improved very well. The thing is, at school we used to be filled with formulas and all kind of stuff which we did not know where they came from and this made our understanding very difficult. After my Cambridge I did not think that I could be doing Maths now because I was very poor in Maths, but now I feel I can do my best even in my Year I."

"I am glad that I have been taught how to tackle Maths problems that I should not let things push me around and indeed I have been a slave of mathematics at school. I used to work out a sum the way it was but not the way I wanted it to be, but not any more. "

"If I could do the Cambridge Maths again I would blast it."

"I though Maths could twist you around but now am sure I can twist it around."

NEWS

From **Lorne Campbell**

I am the chairman of the program committee for the next IEEE Symposium on Information Theory, to be held at St. Jovite, Quebec, Sept. 26-30, 1983. This international symposium is held at intervals of approximately 18 months, and this is the first time that it is in Canada. The general chairman is **Ian Blake** (Eng. Phys. 62, M.Sc. 64) who is married to **Elizabeth Shaver** (Math. 62, M.Sc. 64).

We see from the Queen's Alumni Review that **Michele Coates** (Eng. Math. 1977, M.Sc. 1980), now married to Bob Fauz has had twins (on July 29), John and Colleen. Michele is co-ordinator of post-secondary mathematics and computing at George Brown College, so we suspect she is a busy woman these days!

Also from the Queen's Alumni Review, **John Lamont** (Eng. Math. 1978, M.Sc. 1980) is on leave from CNR (that's the railway) to complete an M.B.A. at Northwestern.

From **John Coleman**

In April, 1982 I visited China for three weeks. En route I stayed for three days in Tokyo with **Donald McLean**, a Queen's graduate who is now working for the Toronto Dominion Bank learning about international banking.

I was invited to the University of Jilin in northern China by its president Dr. Tang Auchin, who is one of China's leading theoretical chemists, to lecture on the theory of Reduced Density Matrices - a topic on which I have researched since 1952. The second-order Reduced Density Matrix is a mathematical object which for many purposes can replace the wave function in the study of many-particle systems in quantum mechanics.

During my week at Jilin, I gave five lectures which averaged about three hours each. They were ably translated paragraph by paragraph. I was amazed by the stamina and attention-span of my audiences. The ten years of the Cultural Revolution have resulted in somewhat less formal relations between students and professor. but in every other respect it seems that the CR was an unmitigated tragedy for the universities and for science in general. Even so I was very favourably impressed by the ability and the level of knowledge of the mathematicians and chemists I met. Among them there is an eager desire to have interaction with Canadian universities. Two young Assistants whom I met may come to Queen's for a couple of years.

After Jilin, I did some sight-seeing in Beijing, met a number of leaders of the Roman Catholic and Protestant Churches, and gave three mathematical lectures in Nanjing. On my way home I met mathematicians and physicists in Hong Kong, Singapore, Madras and Morocco. Finally after lunching with my wine-merchant in London I returned to Toronto by Air Canada, having circled the globe in 52 days, on 19 airplanes and 2 razorblades.

From **John Ursell**

Marg Beattie (Ph.D. 1976) has been appointed Assistant Professor in the Department of Mathematics and Computer Science at Mount Allison University, N. B. Her husband **Ron Beattie** (Ph.d. 1974) is already on staff at Mount Allison.

From **Norm Pullman**

While on sabbatical leave last year I encountered several old Queen's types. **Dr. Rick Routledge** who received his B.Sc. at Queen's in 1970 is now on staff at Simon Fraser University where I spent the first 4 months of the leave. Most of the rest of the time I was based at the University of Newcastle in Australia. I saw former Queen's research assocaites **Colin Sutherland** and **John Phillips** while visitng Sydney. **Jennifer Seberry** (who wa_ a visiting professor at Queen's in 1973-74) is now a leader in the Applied Maths. Dept. at the University of Sydney. I met **Prof. C. C. Chen** (National University of Singapore) while visiting Melbourne where he was on leave, and again at Adelaide where we both were speakers at the 10th Australian conference on combinatorial Mathematics. Professor Chen received his Ph.D. in 1967 in Lattice Theory at Queen's. Other Queen's visitors whom I worked with while in Australia include **Dr. Lou Caccetta** (visiting professor 1980), now at the Western Australian Institute of Technology, **Dr. Peter J. Robinson** (post doctoral fellow 1979-80), now at the University of Queensland and **Prof. W. D. Wallis** (visiting professor 1981) who was my host at the University of Newcastle.

From **Bruce Kirby**

I got a letter from **Ross Ethier** (Eng. Math. 80) who is working towards a Ph.D. in Mechanical Engineering at M.I.T. Evidently he is working extremely hard, taking courses in thermodynamics, fluid mechanics and cell physiology -- some tough stuff after that nice easy math degree. His research efforts involve a study of the fluid mechanics of the eye to help understand glaucoma. He also remarks that tuition at M.I.T. is ≈$15,000 per year. Wow! We hope the scholarships keep coming!

Another letter arrived from **Ann (Weir) Ellis** (Eng. Math '69) in Vancouver who is hoping to do an B.M.A. at U.B.C. She writes:

> "After working as a scientific programmer at U.B.C. and the Department of Environment in Oceanography, I joined a consulting firm as a systems analyst. I worked mainly with scientific and engineering systems although I did design some accounting systems. In 1978 I went to Indonesia with my husband who was working as an assistant project manager for a CIDA project in Sulawesi. Our daughter was both in Indonesia.
>
> "After we returned to Vancouver in 1979 we formed our own company, Gordann Consultants and did freelance consulting. In 1980 we had a son.
>
> "We are now associates in a Geophysical consulting form and I manage several mini-computers that are used out in the bush as well as in the office.
>
> "I'm very happy with the work that I am doing but I want to know more about business and economics and to gain some managerial skills."

From Peter Taylor

Lia Willner (Eng. Math. '80) dropped by my office during a December visit to Kingston to play some "war games" at the National Defence College. She is doing operations research at the Department of National Defence in Ottawa and finds her work, for the most part, interesting and challenging. She has an M.Sc. from Western in Biophysics and is considering a Ph.D. in some area of mathematical modelling.

In June 1982, the Department of Mathematics and Statistics hosted a NATO Advanced Research Workshop on Evolutionarily Stable Strategies. I was Director of the Workshop, and participants came from Canada, U.S.A., Great Britain and West Germany, to spend 3 days talking about the applications of game theory to study the process of evolutionary change (usually in animal behaviour). Immediately afterwards **Joan Geramita** and I attended the International Conference on Population Biology in Edmonton and both presented papers on life history analysis.

Just got a letter from **Steve Gaito** (Math 1981) who is teaching school in Rijau, Nigeria with his wife **Maureen Greyson** (Biol. 1981). He is now 2/3 way through his 2 year appointment and is beginning to discover "what works and what doesn't". Actually his letter is fascinating and would have made an excellent contribution to this issue, but I could not get permission in time to print it. Upon returning to Canada he plans to do graduate work in mathematics. I quote from the end of his letter.

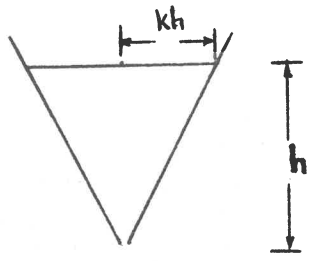
> "I am impressed with how little we know about large-scale dynamical systems, examples of which are: global economics, memory, physiological control, genetic/cellular regulation. I feel that the most experimentally tractable of these problems is that of genetic/celluar regulation, as it is far cheaper to experimentally disrupt a cell than it is to disrupt an economy or a functioning brain.
>
> "Given this interest, I am surmising that the mathematics which mirror these types of problems are in such areas as dynamical systems, lie groups, analysis and functional analysis. While I have an interest in applications of mathematics to cellular biology, I do not wish to take applied mathematics or biomathematics as a study. It is very important for me to continue with my education in pure mathematics while I let my interest in biomathematics suggest fruitful mathematical problems."

PROBLEM

How to exceed g

Here's a curious result. Suppose we take a conical paper cup and fill it with water. Then cut a tiny hole in the bottom. The water will shoot out and the cup will empty. It was Jim Whitley who first alerted me to the disturbing possibility that just before the cup is empty the surface of the water might be dropping with a downwards acceleration that exceeds g . Egad, is nothing sacred! Of course, the result wouldn't bother a physicist who'd merely produce something like viscosity to slow things down at the end, but for us mathematicians who inhabit a smooth frictionless world, the possibility is most disturbing. Just last night I awoke in panic thinking of all those first year calculus students who have blindly calculated for me the time it takes for the cup to empty, without even suspecting that they were violating one of Newton's basic principles.

Let's look at the problem. Let k be the radius:depth ratio of the cone. The water leaves the hole with velocity v obtained from a conservation of energy argument as $v^2 = 2gh$, where h is the current depth. So if A is the cross-sectional area of the hole then the volume V of water in the cup decreases at rate $dV/dt = -Av$. So the rate at which the water level falls is



$$\frac{dh}{dt} = \frac{dV/dt}{dV/dh} = \frac{-Av}{\pi(kh)^2} = \frac{-\sqrt{2g}\,A}{\pi k^2 h^{3/2}}$$

where we use the fact that dV/dh is the area of the top surface of the water. If we suppose the hole is obtained by snipping the cup at height ε , then $A = \pi(k\varepsilon)^2$ and

$$\frac{dh}{dt} = -\sqrt{2g}\,\varepsilon^2/h^{3/2}$$

If we differentiate again with respect to t we get

$$\frac{d^2h}{dt^2} = -3g\left(\frac{\varepsilon}{h}\right)^4.$$

So here it is folks, as soon as h falls below $4\sqrt{3}\,\varepsilon \simeq 1.32\varepsilon$ the acceleration of the surface exceeds g .

Or have I missed something? Please submit your insights.

ONCE UPON A TIME

Once upon a time, when kings were powerful, there was a king who had a baby son. The fig fairy came to his baptism and addressed the king as follows: for my gift to the prince you must choose between skill and imagination. What is this skill? asked the king. Ah, said the fig fairy, notes will fall from his lute as leaves of gold; when he speaks men will shout and women will cry; he will call his horse brother; his frisbee will catch the wind. If you choose skill he will have all these things. And the court sighed in wonder.

Now the king was wise as well as powerful, and knew his fairy-tales well, and replied: let him have imagination, for then he will find these skills if he wants them and others too.

And so, as the prince grew up, he saw what was worth doing and struggled mightily to do it. And even before he tasted of beer, he could with his lute beat golden leaves and spin platinum threads, and when he spoke he made women shout and men cry, and when he whispered in the ear of his horse he could leap over castle walls. And before he tasted of woman, he could make his frisbee loop the loop.

His reputation grew daily and princes and noblemen came from neighbouring lands to seek him. Teach us, they said, to play the lute, and speak mighty words, and ride horses, and throw frisbees. Alas, said the prince, these things cannot be taught; they can only be learned. But I can get you started. He sat them down about him and played his lute for them and he wove a basket of platinum threads and filled it with fine gold leaves. Then he asked them why a horse could run so fast, and how a horse was different from a man and how the same. And he told them the story of Jonathan Livingston Frisbee and moved them to tears.

Then he bade them go and study these things. And some of them did so, and in time became as skilled as the prince himself.

Now people came, in increasing number to the court to learn from the prince, not only noblemen, but merchants and soldiers and even peasants. So the prince gathered his original disciples about him and asked them to help him to teach these people, so that still others might share the skills which had given their lives such richness. But remember, he warned, the skills cannot be taught directly; they can only be learned. You must give them of your imagination.

However, the disciples were not all equally interested or talented in the four skills, so the prince created four courses one in the lute, one in story-telling, one in horses, and one in the frisbee, and let the disciples choose those which they wished to teach.

Now a hundred years passed and the land saw many changes. The prince's descendants were loved and respected but no longer had any power. The school he had established was now the most respected university in the land and still proudly bore his coat-of-arms with the motto **Imagines Accipiat.**

The time had come for the prince's great (×5) granddaughter to go to the university and she asked if they would teach her the skills that her great (×5) grandfather had known and loved. Oh, we could not do that, they said. You see, so much more has been learned about these things than was known in the time of the great prince. You could never learn it all. You must choose one skill, and we will teach you that.

So she enrolled in the Jonathan Livingston School of Frisbee Studies and took courses in frisbee technique, basic and advanced frisbee design, laminar stability, frisbee in the woman's movement, ancient, medieval and modern frisbee, frisbee and society, frisbee gestalt, and finally a project course to design a frisbee for a helium atmosphere. She even took an interdisciplinary course in the School of Equestrian studies on frisbee-catching horses.

When she graduated she could throw a frisbee tolerably well, but by then she had rather lost interest, and she embarked on a career in television. It is too bad, she told one of her former teachers the following year, that I didn't major in elocution; it would have been more use to me. Oh, he replied with remarkable insight, you don't learn that much here anyway. Just be thankful that we know enough about these things, to teach you anything at all! In the olden days they simply didn't have the analytical capacities. Indeed that is what the prince's motto was all about: **Imagines Accipiat.** You must have heard people quote from the last great speech he made before he died. I gather he warned against trying to teach skills directly. I guess all they could do in those days was sit around and inspire one another with their **Imagines.**

Sounds very haphazard to me, said the girl, trying to look doubtful. Oh, it was, he assured her. Some people probably never learned a damm thing.

As the girl turned to leave she asked, almost as an afterthought, say do you think the prince could really loop the loop?

He laughed. Well, you know how stories are. Have you ever handled his original frisbee, the one in the front hall? Actually I guess it's not allowed out of the glass case anymore except at special ceremonies. But I had it in my hands once. It's pretty crude. Hard to imagine it could even get off the ground.

COLEMAN-ELLIS RETIREMENT BANQUET

The Department of Mathematics and Statistics at Queen's will be holding a banquet on the evening of March 26 in honour of John Coleman and Hu Ellis on their retirements.

Former students and colleagues are cordially invited to share in this event, the cost of which will be approximately $15.00. If you wish to attend would you please return the form below before the 18th of March? Further details will be sent to you. [If time forbids you to use the mail we would be grateful for a phone call. The March 18 deadline is absolute. Please call Eileen Wight at (613) 547-2758.]

To: Mrs. E. M. Wight
Dept. of Mathematics and Statistics
Queen's University
Kingston, Ontario

I would like to attend the banquet for John Coleman and Hu Ellis.

I prefer a vegetarian
dinner _____ Name:

Address:

Telephone Number:

Subscribe to Queen's Quarterly

We enclose in this issue of the Communicator a promotional leaflet for the Queen's Quarterly. The pamphlet is self-explanatory but I might just insert here my own personal viewpoint, partly to urge you to read the leaflet and partly to justify its inclusion in our department magazine.

The Quarterly is a mixture of articles, book reviews and poems. Often wide-ranging and thoughtful, they span a large portion of human endeavour, from hunanities to science. Many of the articles are written by those from Queen's and her sister communities. There are many ways to keep in touch with Queen's: the Communicator, the Alumni Review, the annual reunions, and here is another, somewhat different way, possibly richer and more satisfying. Why not give it a try? [PDT]