

If K, K', L, L' denote the complete elliptic integrals of the first kind associated with the moduli $k, k' = \sqrt{1-k^2}, l, l' = \sqrt{1-l^2}$ respectively, with $0 < k, l < 1$, then any relation between k and l which is induced by the condition $n(K'/K) = L'/L$, is called a modular equation of degree n .

The author points out that a modular equation of degree n can be thought of as a relation between theta functions in the argument q and theta functions in the argument q^n .

The final chapter on Rogers–Ramanujan continued fractions is an exception to the others in the sense that some of the proofs are not given. The Rogers–Ramanujan continued fraction was first defined by Rogers, who proved a few of its properties. Ramanujan stated several theorems on them in his notebooks. In fact, his very first letter to Hardy gave a non-trivial evaluation of it.

Define the Rogers–Ramanujan continued fraction as

$$R(q) = \frac{q^{1/5}}{1+} \frac{q}{1+} \frac{q^2}{1+} \frac{q^3}{1+} \dots$$

The author makes clarifying remarks about why $q^{1/5}$ appears.

In Ramanujan’s first letter to Hardy, he asserted

$$\frac{e^{-2\pi/5}}{1+} \frac{e^{-2\pi}}{1+} \frac{e^{-4\pi}}{1+} \frac{e^{-6\pi}}{1+} \dots = \sqrt{\frac{5+\sqrt{5}}{2}} - \frac{\sqrt{5}+1}{2}.$$

The Rogers–Ramanujan continued fraction was one of Ramanujan’s favourite topics of research. As the author mentions, Hardy was so intrigued by Ramanujan’s claims about this function in his letters to him from India that he (Hardy) exhorted Ramanujan to write a paper on it – to quote Hardy:

‘If you will send me your proof *written out carefully* (so that it is easy to follow), I will (assuming that I agree with it – of which I have very little doubt) try to get it published for you in England. Write it in the form of a paper ‘On the continued fraction

$$\frac{x}{1+} \frac{x^2}{1+} \frac{x^3}{1+} \dots,$$

giving a full proof of the principal and most remarkable theorem, viz. that the fraction can be expressed in finite terms when $x = e^{-\pi\sqrt{n}}$, when n is rational.’

This letter was written in December 1913 and Ramanujan sailed to England in March 1914. It was only later in England that Ramanujan published his own proofs on $R(q)$.

In this last chapter, the author provides a proof of Ramanujan’s congruences for $p(n)$ using modular equations of degree 5.

Here is a sample of two modular equations given in this chapter which appear in Ramanujan’s notebooks.

$$\text{If } u := R(q); v := R(q^2),$$

$$\text{then } uv^2 = \frac{v-u^2}{v+u^2}.$$

$$\text{If } w := R(q^3),$$

$$\text{then } 3u^2w^2 = (w-u^3)(1+uw^3).$$

It is to be noted that the material in the last three chapters is not available in books but only in the original sources; therefore, its appearance in this book does a commendable service to the mathematical community.

The author says that the aim of the book is to provide an introduction to the expanse of Ramanujan’s work in number theory and he will be able to cover only a very small fraction of the work on theta functions and q -series. Be that as it may, this is a delightful book written by an expert in this topic from whom it is possible to learn! There are also a large number of exercises interspersed in this 187-page book and, each chapter ends with a set of ‘Notes’ explaining the background and perspective of the results proved there. This book is a real gem.

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Mens et Mania: The MIT Nobody Knows. Samuel Jay Keyser. The MIT Press, 55 Hayward Street, Cambridge, MA 02142, USA. 2011. xxiii + 223 pp. Price: US\$ 24.95.

The Massachusetts Institute of Technology (MIT) remains a place of considerable interest and mystery, rising above its simple designation as an institute of higher education. Being the best engineering school in the country, and perhaps the world, will do that. How it achieved all this in a little over 150 years, and how it maintains it, is of course of interest to both the general public, as well as those looking to recapitulate MIT’s success elsewhere.

In this book Samuel Jay Keyser attempts to give us an insider’s look behind the MIT juggernaut. With over 20 years of experience at MIT, first as a research affiliate, then as department chair and finally as associate provost, Keyser is well suited to provide unique insights into the inner workings of MIT. His personal accounts from his long career at MIT, portrayed with unusual candor, immediately bring the reader in the chaotic world of senior-level management, where executives act more like marriage counsellors than administrators. As the book progresses, however, Keyser writes less about his personal experiences and more about aspects of MIT that fall outside of his purview. This results in sometimes one-dimensional characterizations of features of MIT that are in fact much more complex and far more interesting. Consequently, without a central focus other than Keyser himself, *Mens et Mania* winds up reading more like a memoir than a serious account of the ‘MIT that nobody knows’.

The first half of the book revolves around Keyser’s personal voyage rising through the ranks of academia in Boston. In fact, a few of the chapters have little to do with MIT at all, instead focusing on Keyser’s maturation as a scientist and administrator before ever joining MIT. We are then taken into the world of senior administration at MIT. Keyser, who describes himself as ‘always [as] head of this, director of that, associate provost for something else... someone who stood between the troops and their superiors’, portrays himself almost as a reluctant administrator – a professor-turned-administrator who views his duties more ‘as a

game ... as just one more bureaucracy to outsmart'. In line with his iconoclastic image, he considers himself as a member of the MIT administration, but not 'of' the administration. He brings us into the reality of what someone in his position has to deal with, which involves seemingly endless bouts of conflict resolution. Whether placating protestors, or fending off lawsuits from former students, Keyser repeatedly finds himself in situations which he has never formally been trained for. Not surprisingly, in his usual frank and self-deprecating voice, Keyser admits that he often 'hadn't a clue' what to do in these situations, feeling like a 'marriage counselor trying to reconcile a union between a Jehovah's Witness and a vampire'. It is in these personal accounts of such impossible situations that Keyser really shines, giving the reader backstage passes into what really goes on in the top offices at MIT.

Along with his storytelling, Keyser also shares interesting insights that he had gained during his time as a senior administrator. These include how power is exercised at the administrative level (usually by the 'one who controls the money tap'), or how faculty are often 'under the useful illusion that [they] runs things', while the real power lies with the administration. He further describes the most difficult task of any administrator – ending programmes or 'removing people from the community'. He compares them to divorces, where the resulting bitter sentiments often last until the grave. Keyser also makes repeated references about how the wealth of talent at MIT has a transformative power, turning scientists (including himself) from simply good to great. While these accounts are interesting, how truly unique they are to MIT (as opposed to any other top academic institution) is questionable. What makes MIT unique and distinguishes it from its peer institutions is unfortunately never fully explored.

Keyser continues the book by describing his experiences as Housemaster (faculty manager) of one MIT's most notorious undergraduate dorms, Senior House. This will most likely be the most appealing part of the book to many readers, disclosing a world of sex, drugs, and rock and roll that most would hardly imagine exists at a place like MIT (including annual kegs of nitrous oxide). Soon Keyser finds himself becoming the 'Houseadversary' (as opposed to House-

master) resulting from his numerous confrontations with the residents over issues ranging from drug use to vandalism to even something as mundane as water-efficient showerheads. What stands out in these stories are not the specific details (which are quite interesting), but Keyser's confrontational tone and seemingly one-sided depictions. It is hard not to believe that Keyser still holds a grudge against Senior House, and this is his opportunity to vent. And vent he does. His choice of words to describe the perceived troublemakers (especially given his linguistic training) is particularly interesting: 'hard asses', 'bad guys' and 'self-unaware'. The irony, of course, is that by calling the residents self-unaware, Keyser also holds a mirror to himself, highlighting the fact that while he is generous in assigning blame, he neglects to take any for himself; especially for contributing to a situation in which 20% of the residents actively advocate against his removal. The irony is put on even thicker when Keyser describes later in the book (in regards to sexual-harassment at MIT), 'when thirteen women from the same school have the same complaint, you pay attention'. Why not when 40 residents from the same dorm?

In the last half of the book, Keyser increasingly interweaves his personal views with his experiences. One of Keyser's favourite devices is to apply a psychological lens in order to explain the behaviours of those around him. He uses this quite liberally, whether when trying to explain the relationship between faculty and students at MIT, or the motives behind student-turned-protestors. This, however, often results in overtly simplified or even paradoxical representations. For instance, while Keyser labels the students of MIT as 'America's best young scientific minds', he is quick to ascribe their acts of protest as the result of deep psychological issues – whether as rebellion towards MIT's parental role (which he labels as '*in loco parentis*'), or as a way of dealing with the love/hate relationship they have with MIT (which he labels as 'disobedient dependency'), or as trying to fulfil their pre-existing view of the world (which he labels as 'role compliance'). While these might apply to certain individuals or situations, using such psychoanalytical reductionism to explain the intricate motives of whole groups of people is at best dismissive, and at worst misleading. It is also simply

uninteresting. Keyser's overabundance of psychoanalysis is somewhat surprising, given his own perceived lack of formal psychological training. It rather appears to stem from his own experience of having received psychotherapy while at MIT. Such deterministic accounts, unsurprisingly, hurt Keyser's credibility and thus steal from the last few chapters of the book.

All in all, *Mens et Mania* presents an interesting albeit fragmented picture of a side of MIT that rarely sees the light of day. The book unfortunately never fully delivers on its promise to take us into the 'MIT that nobody knows'. Instead, Keyser sprinkles the book with interesting personal anecdotes from his time in (and out) of MIT. As a result, instead of a systematic account, we obtain a cursory and often one-dimensional portrayal of MIT, with little reference to what makes it such a singular place. It is a shame since this is exactly what makes MIT interesting – how it is *different* from other academic institutes. By veering away from his forte, and attempting to cover too much, Keyser misses this important point. Consequently, the book will read more like a personal memoir of Keyser's own life, rather than a book truly about MIT.

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Our Frugal Future: Lessons from India's Innovation System. Kirsten Bound and Ian Thornton. Nesta, 1 Plough Place, London EC4A 1DE, UK. 2012. 93 pp. Available at http://www.nesta.org.uk/news_and_features/assets/features/our_frugal_future_lessons_from_indias_innovation_system.

What role does diplomacy play in promoting international collaboration in science? Substantial, as a reading of this report will suggest. The report was prepared by Nesta, an independent innovation foundation based in London, with the assistance of the UK Foreign and Commonwealth Office through the Sci-