Opportunities for Mathematicians in the Real World

Rajeeva L. Karandikar

Director, Chennai Mathematical Institute

rlk@cmi.ac.in, *rkarandikar@gmail.com*

When taking up studies in Mathematics, students and their parents would like to know what are the prospects for them after their education.

Traditionally, it was assumed that mathematics education only prepared a student for being a teacher and nothing else.

I would like to say that while this is no longer the case, the job of a teacher in a college or university or an institute has become much better now than say what it was when my generation made up their mind about being in Academica ('70s and early '80s).

For example I did not think that as a Professor I would have a car!

The salaries of teachers have improved as compared to other professions. Of course the salaries in other jobs are higher but the time that people in academics get at their disposal - say to spend with their family or peruse a hobby - is a matter of envy for those in modern high profile jobs. This should be factored in when making a career choice.

Of course here I will talk about what are the opportunities other than academics. Now more than ever there is realization among leaders in industry that mathematical techniques can give an industry an edge over others.

Many sectors such as Finance, Risk Management, Insurance, Marketing now actively look for people having expertise in Mathematical Sciences.

The area which is being called Analytics and BigData is opening up lots of opportunities.

Of course, areas such as production engineering, quality control and quality management, economic planning remain good possibilities.

What is required is that people with training in mathematics should position themselves as experts in **Mathematical Sciences** and not compartmentalize it between pure mathematics, applied mathematics, statistics, operations research, computer science,...

One should view the training during BSc/MSc as training in Analytical thinking. At an abstract level, we basically learn to draw conclusions from a given set of concepts and assumptions.

It is extremely important to keep ones mind open and not say or think that, I have been trained in Pure Mathematics and would have nothing to do with differential equations or probabilistic models, statistics, optimization etc.

Indeed what is of value to an organization is an end to end solution- you need to talk to the end user group who have vague idea that mathematics can help them, to figure out what all out of their wish list you can do, what mathematical techniques may be useful, work out the mathematics and get the answer as a closed form (if you are lucky) or a numerical approximation to the answer and implement the same in such a way that answer can be obtained in reasonable time.

There is no point in working out the optimal solution if it is going to take a month to get an answer to a problem if the answer is needed every day in order to take an action at the start of working hours. Thus, numerical techniques, efficient algorithms etc also come into the picture

So the point is there are opportunities for those who keep an open mind and are willing to learn. In a real job, no one wants you to come up with a solution without looking at books or internet or talking to others. So if a problem requires some background that you don't know, you should be willing to learn.

If someone takes an attitude that I am an expert in Algebra or Differential Geometry (or Operator theory or Quantum Groups or Probability theory or) and will look at a question only if it uses stuff that I know and have studied earlier, then it is not going to work.

Indeed, one should be ready to learn some basic stuff in the potential area of application. Thus, if someone expects to be employed in finance industry, She/He should know some basic economics / finance, be familiar with terms used there.

Most of applications of mathematics in the real world involve statistical ideas and most solutions would require writing some basic program. Thus those who wish to keep the option of job in the industry open, they should learn some basic statistics (use books or web if a course is not offered by your institution) and some basic programming.

I would like to add that Academics or Industry is not necessarily either this or that choice. One can take up academics and be open for industrial consultancy - on one hand this can supplement your income, it may give you satisfaction as well in making a real contribution. And here, one can be doing research in any area of mathematics but can do consulting and use appropriate techniques.