MSF Graduate Programme

Sample Entrance Exam Problems

For students graduating in B.A./B.Sc. (Hons) Maths

This list of problems is meant to give you an approximate idea of the kinds of questions we may ask. It is not comprehensive.

Note that the exam is followed by an interview – what really matters is how you respond to our queries in it. Students who did not do very well in the written test have still been selected if they have picked up our hints and suggestions and corrected their answers during the interview.

1. If a group does not have any proper non trivial subgroups then the group is necessarily
   - (a) a finite group
   - (b) an infinite group
   - (c) a group of order 2
   - (d) none of the above
2. If V is a vector space over a finite field then the dimension of V
   - (a) will be finite
   - (b) will not be finite
   - (c) may be finite or infinite
   - (d) equal to the order of the field
3. Let $P(t)$ be a polynomial of degree 7 with real coefficients. Then $P(t)$
   - (a) has no real roots
   - (b) may or may not have a real root
   - (c) has only real roots
   - (d) has at least one real root
4. If (X, d) is a finite metric space then every non-empty subset of X
   - (a) is not necessarily open
   - (b) is always an open disk
   - (c) is neither open nor closed
   - (d) none of the above
5. Let R be a ring with unity such that there are two elements a and b in R with ab=0. Then always
   - (a) ba=0
   - (b) b=0 or a=0
   - (c) ba may or may not be 0
   - (d) none of the above

6. A continuous function $f : [0, 1] \to [0, 1]$

   (a) has a unique fixed point
   (b) has atleast one fixed point
   (c) has no fixed points
   (d) none of the above

7. The bisection method for finding a root of the equation $f(x) = 0$ is based on the repeated application of

   (a) Rolle's theorem
   (b) Langrange's mean value theorem
   (c) Intermediate value theorem
   (d) none of the above

8. Let T be a linear transformation from a vector space $\mathrm{R}^2 \to R^2$ then T

   (a) always has an eigenvalue
   (b) has two eigenvalues which may or may not be distinct
   (c) has two distinct eigenvalues
   (d) may or may not have an eigen value

9. Let T be a linear transformation from a vector space $\mathrm{V} \to V$. Suppose there exist a linear map $U : V \to V$ such that $TU = I$. Then

10. Can you say anything about the existence of maxima and minima for the function $f(x, y) = x^2 - y^2$ on the circle $C = \{(x, y) : x^2 + y^2 = 1\}$?