Call for a Postdoctoral Position in Mathematics and Mathematical Logic

Università degli Studi dell'Insubria
Università degli Studi di Milano
Italy

In summary

- **Appointment.** Postdoctoral fellowship, 100% research, no teaching duties.
- **Fellowship's Starting Date.** Between June 1st and August 1st, 2012.
- **Duration.** 2 years, renewable to 2 more years subject to the approval of the project coordinators.
- **Host Institution.** Dipartimento di Informatica e Comunicazione, Università degli Studi dell'Insubria, Varese,[1] Italy.
- **Salary.** 2100 Euros after all taxes per month, 12 instalments per year.
- **Allowances.** A one-time allowance of up to 3000 euros towards travel and lodging expenses may be provided to the successful candidate who needs to relocate to the Milanese area. During the project the successful candidate will also benefit from generous financial support in order to attend conferences, carry out research visits, and so on.
- **Deadline for Applications.** Sunday, April 22nd, 2012.
- **Eligibility.** A Ph.D. in mathematics, computer science, or related fields is required. Interested applicants who will not hold a doctoral degree by the above deadline but expect to be awarded one soon are invited to contact us via e-mail to discuss eligibility.
- **How to Apply.** Please send an e-mail message to either Vincenzo Marra or Brunella Gerla (see below for e-mail contacts), no later[2] than April 22nd, 2012. The message should include your expression of interest, your Curriculum Vitæ, a short description of your research activity, and a complete list of your publications. We will notify you about short-listed applications within two weeks. Applicants on the short list will then be instructed on how to take care of the red tape involved in completing an application for the final selection round.
- **Project Website.** `http://www.pnce.unimi.it` .
- **Further information.**
  - Vincenzo Marra (Principal Investigator), Dipartimento di Matematica *Federigo Enriques*, Università degli Studi di Milano, Italy.
    E-mail: `vincenzo.marra@unimi.it`
    Web: `http://marra.dico.unimi.it`
  - Brunella Gerla (Varese Research Unit Coordinator), Dipartimento di Informatica e Comunicazione, Università degli Studi dell'Insubria, Varese, Italy.
    E-mail: `brunella.gerla@uninsubria.it`
    Web: `http://www.dicom.uninsubria.it/~bgerla/`

This call for position was issued on Friday 23rd March, 2012.

The Research Project

It is the eve of the 2006 World Cup Final at Berlin's Olympic Stadium: Italy is going to play France. Consider the sentence $X =$ *"Italy will score in the match against France"*. You do not know for sure whether X will turn out to be true or false after the match. That is why bookmakers take bets on (the event described by) the sentence X — because the information conveyed by X is uncertain. Uncertainty is the realm of the theory of probability. Certainty, by contrast, is the realm of logic. Logic and probability are intimately related. Betting on the compound sentence $X \vee \neg X =$ *"Either Italy will score or Italy will not score in the match against France"* is hardly exciting precisely because the logic of the original sentence X is classical — and so, in particular, X satisfies the *tertium non datur* law that $X \vee \neg X$ is always true. We can reprhase this by saying X describes a classical, yes/no event: one that either obtains, or it does not. Consider next a slight variant of X, the sentence $Y =$ *"Italy will score* early *in the match against France"*. The information conveyed by Y now suffers from two types of imperfection: first, you do not know for sure which instants of time in the course of the match should count as 'early'; second, even if you knew that, you would still not know whether Y will turn out to be true or false after the match. In other words, not only is the information conveyed by Y uncertain, as before; it is also vague. The vague, non-classical proposition Y denotes a vague, non-classical event. This research project tackles the question, can one develop a substantive, mathematically significant probability theory of non-classical events.

The project is structured into five work packages.

(1) Foundational issues for the subjective probability theory of non-classical events.

(2) Duality theory (Stone duality and generalisations).

(3) Measure theory over dual spaces.

(4) Modalities over many-valued logics for reasoning about assignments of probabilities.

(5) Implementation of a software platform to handle bets on non-classical events.

The successful applicant will have research experience in one or more of the following areas.

- Algebraic semantics of non-classical logics.
- Residuated lattices, logics of triangular norms, modal extensions.
- Topological and geometric dualities for Boolean algebras, distributive lattices, Heyting algebras, MV-algebras, lattice-ordered groups and vector spaces, C*-algebras.
- Finitely additive probability theory, de Finetti's coherence criterion, and exchangeability.
- Choquet integrals and capacities, Riesz-type integral representation theorems, generalised measures on spectral spaces.
- Axiomatic approaches to conditional probability, and to Shannon and differential entropy.
- Decidability and complexity in connection with logic, algebra, and topology (word problems, isomorphism problems, satisfiability).

Further information will be shortly available on the project web site (`http://www.pnce.unimi.it`).

Notes

[1] The project main site is the Dipartimento di Matematica *Federigo Enriques*, Università degli Studi di Milano, Milan, Italy, and close interaction with the team in Milan is required. Hence the successful candidate may also choose to reside in Milan and commute to Varese when needed, if s/he so prefers, rather than the other way round. (Commuting time is about 50 minutes by train).

[2] Applicants from abroad are kindly invited to apply as early as possible to help us with the additional bureaucracy involved.