Who needs Logic in CS?

Why do they pay good money for Logic in CS?

What are hot topics in CS?

Microsoft (Cambridge), Facebook, etc.

Logic provides

Exact Languages + Efficient and Reliable Methods/Tools.

It turns out that for many problems - that are known to be a considerable obstruction to the existent computer-aided systems, by means of a small amount of logic we are capable of a dramatic contraction of the search space from exponential to polynomial in size.

Injection of logic, a bit $\implies$ A good deal of effects
1. Formal methods in the modern AI planning with quantitative time constraints.

The aim is to develop an efficient and comprehensive logical tool for a typical AI problem of making a plan of the actions to be performed by a robot so that it could get into a final situation, if it started with a certain initial situation.

A particular focus is on planning under uncertainty caused by actions with non-deterministic effects and actions that may have quantitatively delayed effects in continuous time.
Example 1.1 “Gripper”:∗  
A robot has $k$ grips. It can carry a ball in each.  
The goal is to take $N$ balls from one room to another.  

The number of configurations to be investigated in the planning process seems to be at least exponential $\Omega(2^N)$ since each of the balls, say $b_1, b_2, \ldots, b_N$, has at least two independent states: “in room 1”, or “in room 2”.

They fail for $k = 2, \ N = 41$.

∗During the battle against the Titans, *Briareus*, a hundred-handed giant, took advantage of his one hundred hands by throwing rocks at the Titans. Indeed, Briareus would have failed if he had wasted his time to *individualize* the rocks and hands!
1. Formal methods in AI planning but with quantitative time constraints.

- Max Kanovich and Jacqueline Vauzeilles. Linear logic as a tool for planning under temporal uncertainty. Theoretical Computer Science, 412, 2011, pp.2072-2092
2. Formal verification of software. Effective logical formalisms for resource- and memory-sensitive reasoning

The aim is to develop efficient and comprehensive logical systems and programming tools capable of handling important properties of real-time dynamic systems such as safety, liveness, schedulability, surviveness, simulation, monitoring, etc.

As an effective language for reasoning about heap memory models, we use the formalism of Hoare triples based on separation logic.

Besides the intrinsic technical/theoretical interest of its principles, such as the frame rule and abduction, local reasoning and compositionality, separation logic provides new insights which could be of use in practical applications of logic to program analysis.
2. Formal verification of software. Effective logical formalisms for resource- and memory-sensitive reasoning

Main problems are memory violations and termination.

A bit of logic helps significantly.

Microsoft (Cambridge), Facebook, etc.

Prestigious journals and conferences.
2. Formal verification of software. Effective logical formalisms for resource- and memory-sensitive reasoning


3. Formal systems for assured information sharing within collaborative systems and security protocols with quantitative time constraints.

The aim is to develop efficient and comprehensive logical systems and programming tools to enable multiple parties to share information and at the same time enforce confidentiality, privacy, trust, release, dissemination, data quality and provenance policies.

The formal systems should be capable of handling important properties of real-time collaborative systems such as safety, liveness, schedulability, surviveness, simulation, monitoring, etc.

The aim is to develop efficient logical systems capable of handling security protocols in software, distributed systems, and concurrent systems.
3. Formal systems for assured information sharing within collaborative systems and security protocols with quantitative time constraints.

Security Protocols

Microsoft (Cambridge), Facebook, etc.

Prestigious journals and conferences.
3. Formal systems for assured information sharing within collaborative systems and security protocols with quantitative time constraints.


4. Formal systems in computational linguistics.

The aim of this research is to develop comprehensive and efficient logical formalisms capable of handling syntactical and semantical properties of artificial and natural languages.
Он из Германии туманной привез учености плоды

Кто туманный …

Он из Германии туманной привез учености плоды

Lambek Calculus:

sweet sweet home, very sweet home, very home
5. Model Checking.

In particular, the aim is to develop efficient and comprehensive logical systems and programming tools for the systems with user-defined inductive predicates (such as lists, trees, etc.) as used in program verification.

et cetera, et cetera