are shunned.

Defenders of the status quo say there is a weak Catholic supply chain in the arts and humanities—they claim that "all the really smart Catholics have gone into law or medicine or business," Miscamble notes. Applicants are dismissed as "not good enough" if they lack the "imprimatur of an elite graduate school (the Ivy League, Chicago, Berkeley, or Stanford, with an occasional stoop down to Michigan)." Unless the university's trustees seize the initiative, requiring two-thirds of all faculty hires to be Catholic, schools such as Notre Dame will surrender their distinctiveness, abandoning the prospect of creating communities "animated by the spirit of Christ," Miscamble says.

John T. McGreevy, one of Miscamble's successors as chair of the Notre Dame history department, says that Miscamble ignores certain pesky facts.

> The University of Notre Dame is now embroiled in a growing dispute over whether it is hiring enough Catholics.

Much of the work of a professor in a Catholic university is not confessional, McGreevy says. Rather, it involves the cultivation of areas of expertise that "resonate with the long, rich heritage of Catholic Christianity." These include medieval philosophy, sacred music, the sociology of religion, and political theory. History classes are more likely to focus on religious history and on Latin America and Europe than at other institutions. To that end, Notre Dame has hired Protestants, Muslims, Jews, and non-believers who are all enthusiastic about the university's mission.

But McGreevy agrees that Notre Dame students need the "witness of Catholic intellectuals attempting to live out faith commitments in the modern world." The problem truly is numbers, he says. Only six percent of the tenure-track scholars in the arts and sciences or business at the nation's top universities identify themselves as Catholic, according to a 2006 study. Moreover, two-career couples are often reluctant to relocate to small college towns such as South Bend, Indiana, where one spouse may wind up without a job or underemployed. Despite these challenges, however, more than half of Notre Dame's faculty hires last year were Catholic. Properly understood, McGreevy says, his university's Catholic identity is quite secure.

SCIENCE & TECHNOLOGY

The Checkers Terminator

THE SOURCE: "Checkers Is Solved" by Jonathan Schaeffer, Neil Burch, Yngvi Björnsson, Akihiro Kishimoto, Martin Müller, Robert Lake, Paul Lu, and Steve Sutphen, in ***Science***, Sept. 14, 2007.

Marion Tinsley, the greatest checkers player who ever lived, managed to narrowly beat a computer in 1992. Today, the best a player of his caliber could manage would be a tie. That's because computer researchers at the University of Alberta have managed to "solve" the game. By analyzing an opponent's moves, their program can counter with a winning strategy or, at worst, play to a draw.

Despite checkers' reputation as an easy game, solving it, say Jonathan Schaeffer and his colleagues, "pushes the boundary of artificial intelligence [AI]." The game's possible positions, with 24 pieces moving on 32 black squares, amount to 500 billion *billion* (5×10^{20}).

Efforts to construct a checkers-playing program capable of beating a human began back in the 1950s with pioneering work by Stanford University's Arthur Samuel; in 1963 his program won a game (but not the match) against a capable player. That victory was "heralded as a triumph for the fledgling field of AI," say the authors, all of whom are connected with the University of Alberta. But it was the Chinook program, launched by Schaeffer in 1989, that took on Tinsley (whose declining health prevented him from finishing a rematch). The version of the program available at the time relied on a database of all possible endgame positions once players were down to four pieces a side. Anything beyond that outstripped existing computing capacity.

The current version of Chinook employs a five-piece-or-fewer-per-side endgame database (39 trillion

possible positions!), as well as two forward-searching algorithms that kick in from the first move, analyzing possible outcomes of moves in terms of achieving a win, loss, or draw.

The database still does not contain all possible positions that can arise in the game. Compiling such a database, the authors say, though theoretically possible, would make playing the game "impractical with today's technology." It would take too long for the computer to crunch the data. Nonetheless, Schaeffer and colleagues believe that, armed with their current program, they could do no worse than tie a mistake-free player. (Even the great Tinsley lost three times from 1950 to 1991.)

Is there any significance to all of this, beyond mere game-playing? Schaeffer and his coauthors think so. "The project has been a marriage of research in AI and parallel computing, with contributions made in both of these areas"; they performed computations on up to 50 computers simultaneously.

Behind such practical concerns, though, lurks the geeks' grail: With checkers now largely conquered, will chess ever be solved? Maybe, the researchers say, but not for a long time. The possible moves in checkers, though vast, represent only the *square root* of the possible chess moves, which are something on the order of 10^{120}. (Scientists estimate the number of atoms in the known universe at only 10^{75}.) "Playing chess is like looking out over a limitless ocean," Tinsley once said. "Playing checkers is like looking into a bottomless well."

SCIENCE & TECHNOLOGY

Snows of Kilimanjaro

THE SOURCE: "The Shrinking Glaciers of Kilimanjaro: Can Global Warming Be Blamed?" by Philip W. Mote and Georg Kaser, in ***American Scientist***, July–Aug. 2007.

STARTLING BEFORE-AND-AFTER images of the retreating glacier on Tanzania's Mount Kilimanjaro in *An Inconvenient Truth*—the 2006 documentary that helped Al Gore win a share of the Nobel Peace Prize—bear seemingly convincing witness to the growing perils of global warming. As in so many instances in the global climate debate, however, the reasons why Kilimanjaro's 11,000-year-old glacier is dwindling are complex, and "bear only indirect connections, if

EXCERPT

The New Salmon Route

For ordinary humans, the extraordinary migration of salmon is difficult to imagine. Take Chinook salmon. Some of these fish swim from the Columbia River up to Canada and beyond. That would be the equivalent of a human swimming more than 160 miles a day—fast enough to circumnavigate the equator in 150 days. . . .

If the mileage clocked by these fish sounds impressive, it is nothing compared to the journeys some of them take after their death. In the case of salmon, it is all because of their pin bones—dozens of tiny bones not connected to the rest of the fish's skeleton that cannot be dealt with by filleting machines. Pin bones must be extracted by hand using tweezers or small pliers. It is a laborious process that when carried out in North America or Europe is costly. Not in China, though, with its low wages and high productivity. . . .

A typical . . . Norwegian salmon destined for sale in a supermarket in America or Europe [would pass, frozen, through Rotterdam or Hamburg, before sailing to Qingdao in China for processing by young women from rural villages]. Using nimble fingers and small scalpels, they swiftly skin the salmon, remove its bones, and cut it into the exact portions specified by a Western supermarket chain on the other side of the world. Once the fish is filleted and in pieces, it is refrozen, packed onto a ship, and sent back to Europe or the United States. By the time it reaches the supermarket, our "fresh" salmon may have been traveling for an astonishing two months.

—**SARAH MURRAY**, author of *Moveable Feasts: From Ancient Rome to the 21st Century, the Incredible Journeys of the Food We Eat*, adapted in ***Orion*** (Nov.–Dec. 2007)