SEO Practitioners: Unlike researchers, SEO practitioners have a very strong incentive to re-discover what Google and other search engine companies already know about their ranking algorithms. From their daily experiences monitoring the websites' rankings and analyzing their websites' logs, SEO practitioners and webmasters are typically well attuned to the algorithms' frequent changes. Such experiences are disseminated through various online discussion forums, on the websites of SEO companies, and in popular press books written by the experienced SEO practitioners—and turn up copiously in searches for "search engine optimization." The main criteria applied in selecting from such discourse of uneven quality was its credibility. Accordingly, this tutorial draws, in particular, on books whose success has earned them recent second or third editions [4]–[6] and, hence, whose extended exposure in the commercial marketplace would have somewhat tested their SEO advice. It also draws extensively on the latest in a series of biennial surveys about SEO techniques conducted by the SEO software company and community hub SEOmoz [7]. This latest survey, conducted in March 2011, asked 134 SEO industry professionals to rank more than 100 suspected SEO factors according to their estimated influence in Google's ranking algorithm.

Search-Related Terminology This section introduces general search-related terminology that reappears throughout this tutorial. More specialized terms are defined and/or described at points where they are introduced in the key lessons below.

According to the Search Engine Marketers Professional Organization, the main American-based organization that represents practitioners in the field, **search engine optimization (SEO)** is "the process of editing a web site's content and code in order to improve visibility within one or more search engines" [8]. The similar term **search engine marketing (SEM)** includes SEO plus various paid advertising options that involve search engines, options that are beyond the score of this tutorial. SEO is typically understood not to include—or at least not to overly rely on—these paid options in its aim to achieve high rankings among search engines' **organic** ("natural") **results**, listings of webpages that a search engine derives by "appl[ying] formulas (**algorithms**) to its search crawler index, combined with editorial decisions and content weighting . . . " [8]. These ranked listings appear on **search engine results pages (SERPs)**, often surrounded by **sponsored results** (paid advertising), after users enter a search query. For their organic results, SERPs typically default to listing ten webpages, featuring for each its title hyperlinked to the webpage, a "**snippet**" of text often excerpted from the page, and the page's **URL** (web address).

Search engines collect their search **index** (corpus of web content) in the first place mainly by using a **spider** (a program, also called a bot or a crawler) to repeatedly **crawl** (surf) the web link by link and record new and updated pages, defunct links, and so forth. The index includes the words on the crawled webpages along with their location and accompanying web coding. While this tutorial focuses mainly on nontechnical means of SEO, those responsible for websites ought to know some **HTML** (hypertext markup language), the most fundamental form of web coding, in which various **tags** and their **attributes** are used to encode the structure, design, and functionality of a webpage.

Three Classes of Participants Shaping Search Rankings This section draws on the literature to explain how search engine rankings are directly and indirectly shaped by the three classes of interdependent participants introduced in the Theoretical Framework section above:

(1) search engine companies and programmers
(2) webmasters and SEO practitioners
(3) search engine users.

Search Engine Companies and Programmers: Searchers using more than one search engine will likely have noticed that for a given query, the competing SERPs tend to show different rankings, and indeed often show different sites entirely, an observation confirmed by researchers [9]–[11]. Each search engine company has wittingly or unwittingly programmed its own biases. One study observed that in comparison with their competitors, search engines tended to favor sites and services that their own companies owned, with Google's SERPs listing Google-owned YouTube more often than its competitors did, and Yahoo listing Yahoo Answers more often [12]. Another study found that Google tended to return more commercial results among its top ten than did its erstwhile competitors Yahoo and MSN [13].

Perhaps the most distinctive and successful feature of Google's algorithm is **PageRank**, which (then) Stanford University doctoral candidates Sergey Brin and Lawrence Page introduced in a 1998 article about what was then their prototype search engine [14]. PageRank is a measure of the popularity of

a webpage as determined by the hyperlinks from other pages leading to it, as well as the popularity of those linking pages themselves. It is now just one of more than 200 factors that figure in Google's algorithm [15]. Google's Matt Cutts, a frequent spokesperson on SEO issues, conceptualizes these 200-plus into two general classes [16]:

(1) Trust—of which PageRank is only the most well-known component—an assessment of a site's authority and reputation
(2) Relevance—an assessment of how well a site topically matches a particular query.

Google's, and other search engines', emphases on popularity, authority, and reputation have raised alarm at least as far back as Introna and Nissenbaum's much-cited critique of search engine rankings' inherent, undemocratic "political" biases [17]. Introna and Nissenbaum, as well as others (e.g., [18]), argued that search engines systematically promoted some sites, such as those already popular or benefiting from SEO tactics, and effectively denied or restricted public access to the vast proletariat of the web's sites by ranking them poorly or indexing them only partially or not at all. For instance, a 2008 study, drawing on a dataset of a search engine's top 100,000 queries, found that Wikipedia was listed in Google's first SERP for more than one-third of such queries, placing first for almost one-sixth of such queries [12]. More recently, two 2012 studies found that Wikipedia's dominance had increased to the point where it ranked first in approximately half of Google and Bing searches [19], [20]. Such "rich-get-richer" predispositions accentuate the challenge faced by webmasters and SEO practitioners trying to attract attention to new or less popular sites. On the other hand, some researchers have argued that search engines promote a more democratic, "egalitarian" access to a wider range of sites [21], at least in certain fields [22].

Though Google's rankings and those of other major search engines are automated, they are not necessarily consistent. For instance, entering the same query into Google from different web browsers (e.g., Internet Explorer, Firefox, Chrome, Safari, etc.) can produce different SERP rankings, as Google monitors the "sociological" patterns of each browser's community of users. Entering the same query at different locations can produce different SERP rankings, as Google maintains different data centers throughout the world, not always fully synchronized with each other [23], [24].

Entering the same query at different times, even minutes apart, can produce different SERP rankings, as Google tweaks its algorithm as many as 500 or more times per year [25], [26]. The SEO software company and community hub SEOmoz has cataloged more than 50 major changes over the past dozen years, many of enough consequence to have been dubbed with a nickname from Google itself or, more commonly, from the SEO community [26].

Also, different search queries are thought to trigger somewhat different Google ranking algorithms [27]. According to the SEOmoz survey of SEO industry professionals introduced before, these algorithmic differences lead to Google SERPs that are thought to sometimes favor recently updated webpages, or a greater diversity of webpages, or well-established "brand" websites. The same survey question revealed that Google is widely thought to apply specific ranking factors to queries within specific topical categories, such as travel, e-commerce, real estate, and so forth [7]. Hence, though this tutorial will follow convention and refer to Google's algorithm in the singular, it may be more accurate to conceive of its algorithms in the plural.

Webmasters and SEO Practitioners: Complicating the efforts of search engines to serve what searchers are looking for is the work of webmasters—not all of whom have the motivation, time, communication skills, or technical skills to optimally communicate their web content to search engines—and of wily SEO practitioners, who are well motivated to devote their time, communication, and technical skills to achieving rankings higher than their site content might otherwise merit. Perhaps revealingly, SERP rankings for commercially oriented queries—the kind of queries for which companies would hire SEO specialists—have been found to be more volatile over time than rankings for queries without a direct commercial intent [28].

In the intense competition to achieve higher rankings, some SEO practitioners resort to black hat techniques conceived to game search engines' algorithms. Among the many such techniques are **keyword stuffing**, in which excessive keywords are inserted within the coding or cloaked behind the content of a webpage; and **link farming**, in which sites filled with outbound links are posted for the purpose of making the destinations of those links appear popular to search engines [29]. Such tactics have led search engine companies to publish guidelines listing do's and don't's that specify what they deem to be ethical SEO practices,

and to penalize websites that violate the guidelines with lower rankings or exclusion from the search engine's index (e.g., [30]). Also, search engines have frequently changed their ranking algorithms, as mentioned before, in their ongoing whack-a-mole attempts to overcome black hat techniques.

Search Engine Users: Finally, web users' search engine preferences and behaviors, in turn, influence web marketers' SEO strategies and search engines' rankings. For years, Web users have been favoring Google by wide margins over such competitors as Yahoo and, more recently, Bing [31]–[33]. As well, as a result of a 2009 agreement between Yahoo and Microsoft, Yahoo's search results are now served by Bing's algorithm. Accordingly, SEO industry professionals, following their users, optimize their sites primarily for Google's algorithm and secondarily for Microsoft's Bing and others, and so this tutorial frequently focuses on optimizing for Google, though the SEO lessons detailed below also apply in varying degrees to most other general web search engines.

In a 2012 survey by the Pew Internet and American Life Project, majorities of searchers reported that they trusted search engines as a "fair and unbiased source of information" and that, in their experience, search engine results had been "getting more relevant and useful over time" [33, pp. 10–11]. Also, majorities reported that they were confident in their search abilities and that they found what they were looking for most or all of the time, though a large minority also reported that they felt overwhelmed by the volume of search results [33]. In line with such attitudes, many studies have observed that searchers tend to limit themselves to the first SERP [34], [35], and often to just the top-ranked results on that SERP [36], even when the order of those results has been experimentally reversed from top to bottom [37], [38]. Accordingly, SEO industry professionals are driven to earn not just a good ranking but a top ranking.

Google acknowledges in its new privacy policy that it tracks the history of individual users of its various services, including its search engine, so that it can serve up a more targeted experience to each user [39], though a majority of respondents to the Pew Internet Project survey introduced before objected to such tracking of their search engine queries [33].

Searchers' behavior patterns are thought to influence not just their own search results but those of everyone else. According to the SEOmoz survey of SEO industry professionals introduced before [7], among the collective user behaviors thought to be among the more influential in Google's ranking algorithm are the following:

- The "**click-through rate**" (CTR) from Google to a webpage—that is, for a given search query, the percentage of times searchers click on the link to a particular webpage listed in Google's SERP. A high CTR indicates to Google that searchers entering that query judge that webpage to appear highly relevant, and accordingly Google's algorithm is thought to weigh that in its favor in future searches.
- The "**bounce rate**" from the webpage back to Google—that is, for a given search query, the percentage of searchers who return from a "clicked-through" webpage back to Google's SERP to try some other webpage. A webpage's bounce rate has the reverse effect of its CTR: a high bounce rate indicates to Google that searchers entering that query are disappointed with that webpage and, accordingly, Google's algorithm is thought to weigh that against it in future such searches.

Other survey responses indicated that such measures of user behavior for one query and one webpage are somewhat contagious across rankings for a site's other queries and other pages. When asked in yet another survey question whether the collective weight of these user behaviors in Google's algorithm would decrease, stay the same, or increase over the subsequent twelve months, almost 70% of the respondents predicted that it would increase [7]. If these assumptions are valid, webmasters and SEO practitioners have an additional reason to ensure that the brief bits about their sites that are featured on SERPs are not only inviting but also accurate in order to encourage a higher CTR while discouraging a correspondingly higher bounce rate—the focus of lesson 2 in the next section.

KEY LESSONS

The interests and interplay of these three classes of participants have led to search engine ranking algorithms that remain relatively unpredictable. To optimally ensure that their audiences can nevertheless find their web content, web developers can guide themselves with heuristics as they compose and maintain their web content and engage with other web content creators. These heuristics are detailed in three key lessons, in