

## Programming Assignment 1

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1. The index can be created using the “index” argument (see install.pdf).

2. Here are the query results (sorry for the mess!):

Query: power nap benefits

id: 85bcaa2516682b1738c121bfd1d7bd60c9d2e274

text: The power nap is thought to maximize the benefits of sleep versus time. It is used to supplement normal sleep, especially when a sleeper has accumulated a sleep deficit.

id: 76cae6cb9749c647ae52077d6fd535f3ccdb41a2

text: Some companies have nap rooms to allow employees to take a power nap. This may be in a form of a nap room with a recliner, or chairs specially designed for power napping installed in a designated area. Companies with nap rooms claim that employees are happier and become more productive at work.

id: 05ee98915108d6fea8b95d4aefd51acadf85bb3a

text: For several years, scientists have been investigating the benefits of napping, both the power nap and much longer sleep durations as long as 1–2 hours. Performance across a wide range of cognitive processes has been tested. Studies demonstrate that naps are as good as a night of sleep for some types of memory tasks.

id: 9fe0ea9205e708269ec2cf437aa23360c5805a8b

text: A Flinders University study of individuals restricted to only five hours of sleep per night found a 10-minute nap was overall the most recuperative nap duration of various nap lengths they examined (lengths of 0 min, 5 min, 10 min, 20 min, and 30 minutes): the 5-minute nap produced few benefits in comparison with the no-nap control; the 10-minute nap produced immediate improvements in all outcome measures (including sleep latency, subjective sleepiness, fatigue, vigor, and cognitive performance), with some of these benefits maintained for as long as 155 minutes; the 20-minute nap was associated with improvements emerging 35 minutes after napping and lasting up to 125 minutes after napping; and the 30-minute nap produced a period of impaired alertness and performance immediately after napping, indicative of sleep inertia, followed by improvements lasting up to 155 minutes after the nap.

id: 0a0af8bdfc8a4ead32792ccd702dd6455e068d16

text: A power nap is a short sleep which terminates before the occurrence of deep sleep or slow-wave sleep (SWS), intended to quickly revitalize the subject. The expression was coined by Cornell University social psychologist James Maas.

id: 1b470a36adea668e666acefd8b82ba1336620315

text: Various durations are recommended for power naps, which are very short compared to regular sleep. The short duration of a power nap is designed to prevent nappers from sleeping so long that they enter a normal sleep cycle without being able to complete it. Going beyond sleep stages I and II but failing to complete a full sleep cycle can result in a phenomenon known as sleep inertia, where one feels groggy, disoriented, and even more sleepy than before

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beginning the nap. Brief naps (10–15 minutes) can improve alertness directly after awakening without the detrimental effects of sleep inertia associated with longer naps.

id: 0bb27470730936e60db6de54836ef6700c58e53f

text: Similar nap rooms and stations also exist in higher education institutions. Many colleges and universities provide napping furnitures such as cots and giant bean bags in libraries for students to take a nap after a long study. At least one university has a nap room set up in a gym. Some medical schools also set up nap rooms at the teaching hospitals. The nap rooms may include sleeping pods or cots, white noise machines, and antimicrobial pillows.

id: bf2d3d9fab4e234bcf4ce753f9e99a8c90e9cea9

text: People who regularly take power naps may develop a good idea of what duration works best for them, as well as what tools, environment, position, and associated factors help induce the best results. Some may prefer to take power naps regularly even if their schedules allow a full night's sleep. Mitsuo Hayashi and Tadao Hori have demonstrated that a nap improves mental performance even after a full night's sleep. New sleep sensors and sleep timers available on several mobile devices allow advocates of power naps to sleep for exactly as long as they would like to.

id: 31b12608564134c2d86ad73ed53f5ad7997f1caa

text: A brief period of sleep of around 15 to 20 minutes, preceded by consuming a caffeinated drink or another stimulant, may combat daytime drowsiness more effectively than napping or drinking coffee alone. A stimulant nap (or coffee nap, caffeine nap, occasionally napuccino) was discovered by British researchers, Horne and Reyner, to be more effective than regular naps in improving post-nap alertness and cognitive functioning. In a driving simulator and a series of studies, Horne and Reyner investigated the effects of cold air, radio, a break with no nap, a nap, caffeine pill vs. placebo and a short nap preceded by caffeine on mildly sleep-deprived subjects. A nap with caffeine was by far the most effective in reducing driving "incidents" and subjective sleepiness as it helps the body get rid of sleep-inducing chemical compounds known as adenosine. Caffeine in coffee takes up to half an hour to have an alerting effect, hence "a short (<15min) nap will not be compromised if it is taken immediately after the coffee." One account suggested that it was like a "double shot of energy" from the stimulating boost from caffeine plus better alertness from napping. This procedure has been studied on sleep-deprived humans given the task of driving a motor vehicle afterwards, although it has not been studied on elderly populations.

id: 857c9393cc9f1438f3dc5a08f512226abc414e87

text: Power naps of fewer than 30 minutes—even those as brief as 6 and 10 minutes—restore wakefulness and promote performance and learning. A 30-minute nap may also be able to reverse the hormonal impact of a night of poor sleep or reverse the damage of sleep deprivation. A University of Düsseldorf study found superior memory recall once a person had reached 6 minutes of sleep, suggesting that the onset of sleep may initiate active memory processes of consolidation which—once triggered—remains effective even if sleep is terminated.

Query: whale vocalization production of sound

id: 8e2821b4d1948204788a311bb15a0989577aa8df

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text: Cetacean sound production differs markedly from this mechanism. The precise mechanism differs in the two major suborders of cetaceans: the Odontoceti (toothed whales—including dolphins) and the Mysticeti (baleen whales—including the largest whales, such as the blue whale).

id: 35a73dca142e7e4ceb6716d9583b3486e2c19051

text: Most baleen whales make sounds at about 15–20 hertz. However, a team of marine biologists, led by Mary Ann Daher of the Woods Hole Oceanographic Institution, reported in New Scientist in December 2004 that they had been tracking a whale in the North Pacific for 12 years that was "singing" at 52 Hz. The scientists are unable to explain this dramatic difference from the norm; however, they believe the whale is baleen and unlikely to be a new species, suggesting that currently known species may have a wider vocal range than previously thought. There is disagreement in the scientific community regarding the uniqueness of the whale's vocalization and whether it is a member of a hybrid whale such as the well documented Blue and Fin Whale hybrids.

id: 52d1827627d2fdb8271eed24f71a424769595951

text: Researchers use hydrophones (often adapted from their original military use in tracking submarines) to ascertain the exact location of the origin of whale noises. Their methods also allow them to detect how far through an ocean a sound travels. Research by Dr. Christopher Clark of Cornell University conducted using military data showed that whale noises travel for thousands of kilometres. As well as providing information about song production, the data allows researchers to follow the migratory path of whales throughout the "singing" (mating) season. An important finding is that whales, in a process called the Lombard effect, adjust their song to compensate for background noise pollution. Moreover, there is evidence that blue whales stop producing foraging D calls once a mid-frequency sonar is activated, even though the sonar frequency range (1–8 kHz) far exceeds their sound production range (25–100 Hz).

id: 750b53d8441e81fd9f87e3a41dee7c8fdd7be9ca

text: The multiple sounds odontocetes make are produced by passing air through a structure in the head called the phonic lips. This structure functions like the human nasal cavity. As the air passes through this narrow passage, the phonic lip membranes are sucked together, causing the surrounding tissue to vibrate. These vibrations can, as with the vibrations in the human larynx, be consciously controlled with great sensitivity. The vibrations pass through the tissue of the head to the melon, which shapes and directs the sound into a beam of sound useful in echolocation. Every toothed whale except the sperm whale has two sets of phonic lips and is thus capable of making two sounds independently. Once the air has passed the phonic lips it enters the vestibular sac. From there, the air may be recycled back into the lower part of the nasal complex, ready to be used for sound creation again, or passed out through the blowhole.

id: fbff039e5c107c9f8be00da48add3995428773d7

text: Humpback whales may also make stand-alone sounds that do not form part of a song, particularly during courtship rituals. Finally, humpbacks make a third class of sound called the feeding call. This is a long sound (5 to 10 s duration) of near constant frequency. Humpbacks generally feed cooperatively by gathering in groups, swimming underneath shoals of fish and all lunging up vertically through the fish and out of the water together. Prior to these lunges, whales

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make their feeding call. The exact purpose of the call is not known, but research suggests that fish know what it means. When the sound was played back to them, a group of herring responded to the sound by moving away from the call, even though no whale was present.

id: a3c550c198a78e23bbee44b25db74e7b743b573e

text: Baleen whales (formally called mysticetes) do not have phonic lip structure. Instead, they have a larynx that appears to play a role in sound production, but it lacks vocal cords, and scientists remain uncertain as to the exact mechanism. The process, however, cannot be completely analogous to humans, because whales do not have to exhale in order to produce sound. It is likely that they recycle air around the body for this purpose. Cranial sinuses may also be used to create the sounds, but again researchers are currently unclear how.

id: 711eb45bef2339ddc2cd090e60899c756feb493d

text: Two groups of whales, the humpback whale and the subspecies of blue whale found in the Indian Ocean, are known to produce a series of repetitious sounds at varying frequencies known as whale song. Marine biologist Philip Clapham describes the song as "probably the most complex in the animal kingdom."

id: c4c746a886f0c06688bad3d9419cd5fb56fc1ffb

text: Interest in whale song was aroused by researchers Roger Payne and Scott McVay after the songs were brought to their attention by a Bermudian named Frank Watlington who was working for the US government at the SOFAR station listening for Russian submarines with underwater hydrophones off the coast of the island. Payne released the best-selling Songs of the Humpback Whale in 1970, and the whale songs were quickly incorporated into human music by among others singer Judy Collins.

id: 776ad7a0fdb5a50aac95f0a44468aa6a5310a41b

text: Prior to the introduction of human noise production, Clark says the noises may have travelled right from one side of an ocean to the other, agreeing with a thirty-year-old concept blaming large-scale shipping. His research indicates that ambient noise from boats is doubling with each decade. This has the effect of reducing the range at which whale noises can be heard. Environmentalists fear that such boat activity is putting undue stress on the animals as well as making it difficult to find a mate.

id: 33f7ccf51ab0c242135ce906c6a26328a17d9308

text: While the complex sounds of the humpback whale (and some blue whales) are believed to be primarily used in sexual selection, the simpler sounds of other whales have a year-round use. While toothed whales are capable of using echolocation to detect the size and nature of objects, this capability has never been demonstrated in baleen whales. Further, unlike some fish such as sharks, a whale's sense of smell is not highly developed. Thus, given the poor visibility of aquatic environments and that sound travels so well in water, sounds audible to humans may play a role in navigation. For instance, the depth of water or the existence of a large obstruction ahead may be detected by loud noises made by baleen whales.

Query: pokemon puzzle league

id: 80f928fd3ba87a70411de560d51b93abf2c6bb66

text: Pokémon Puzzle League is a puzzle game for the Nintendo 64 console. It is based on Nintendo's Puzzle League puzzle games, but with Pokémon likenesses. It was only available in

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North America starting in 2000, and in Europe in 2001, making it the first Pokémon game produced for North America. It is one of several Pokémon games to be based on the Pokémon anime, and features Ash Ketchum and other characters featured from the anime. The game was released on the Virtual Console on May 5, 2008, in the North America region, and on May 30, 2008, in the European region.

id: 5df575da5cd13dd1d045119ae9aef434c7875707

text: Pokémon Puzzle League received generally positive reviews from the media, scoring 81/100 on Metacritic, and 82.65% on GameRankings. Electronic Gaming Monthly gave the game a 9.2/10, noting its similarity to Tetris Attack, and calling it "highly addictive". IGN rated the game 8.9/10, stating "I'm totally addicted and thrilled with Pokémon Puzzle League."

id: 4a98bf4038f1cb4bf44e91953a52bd51f6c527aa

text: Unlike its predecessors, Pokémon Puzzle League features a 3D mode in addition to the traditional 2D mode. In this mode, gameplay takes place on a cylinder with an effective width of 18 blocks, compared to the six-block width of the flat 2D field. It also features the original block design from Panel de Pon and Tetris Attack, as well as a Pokémon-oriented design (which is selected by default).

id: 29495dcc618b43427fd2f5920a5dc9decce54049

text: Pokémon Puzzle League features the same gameplay as in Panel de Pon. The objective is to clear blocks from the playfield by arranging them in horizontal or vertical lines of three or more blocks. A continuous stream of new blocks pushes up from the bottom of the playfield, causing the entire playfield to rise continuously. If the blocks reach the top of the playfield, the player loses. The player can temporarily stop the progression of blocks by scoring combos and chains, and in two-player battles, these actions also cause garbage blocks to stack on top of the opponent's playfield.

id: 3f28912fb9c6b2fa4377414a348275e59b7d90f5

text: There is currently a women's league playing six-(wo)man football. It is the Independent Women's Football League.

id: c1ebc5e2ad12505f150b8949a56c774bb7720183

text: The characters in Pokémon Puzzle League either come from the anime and were once exclusive to it, like Ash Ketchum, Tracey Sketchit, and Gary Oak or have appeared in previous Pokémon games but appear in the game as they do in the anime like Misty, Brock, and Giovanni. There are 16 playable characters in the game. In the 1P Stadium, only Ash is playable and Gary's Pokémon, a Nidoran♀, Growlithe, and Krabby, will fully be evolved into Nidoqueen, Arcanine, and Kingler, respectively, in Hard mode, Very Hard mode, and Super Hard mode when challenging him the second time. These fully evolved Pokémon are not playable with Gary. The final opponent of each difficulty setting varies. Giovanni is the last opponent of Easy mode, Bruno is the last opponent of Normal mode, and Gary with his evolved Pokémon is the last opponent of Hard mode. In Very Hard mode and Super Hard mode, Mewtwo is the final opponent, and beating him gives the player the true ending of the story in 1P Stadium.

id: 122d144c144f20998d6c8a48c91a0af7bc81ac04

text: Coors Field was the first major league park with an underground heating system.

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id: 6e296b55cad6d942cef7e68097d2c29eb6d446c6

text: The Duchy of Pomerania joined the Schmalkaldic League, but did not actively participate in the Schmalkaldic War.

id: d75ff7b28136f10a94889bcd2f6c3200dcc3e7f

text: John Perry "Jack" Pardee (April 19, 1936 – April 1, 2013) began his football career as a teenager in Christoval Texas, where he excelled as a member of the six-man football team. He was an All-American linebacker at Texas A&M University and a two-time All-Pro with the Los Angeles Rams (1963) and the Washington Redskins (1971). He was one of the few six-man players to ever make it to the NFL, and his knowledge of that wide-open game would serve him well as a coach. Pardee was inducted into the College Football Hall of Fame as a player in 1986. Following his playing career, Pardee went on to coach becoming the only head coach to helm a team in college football, the National Football League, the United States Football League, the World Football League, and the Canadian Football League.

id: 6d3fff9a7a74078c5b68a6f63e1fc7691f81d50e

text: The 1998 Major League Baseball All-Star Game took place in Coors Field.

3. The default scoring function is BM25 (Okapi BM25). I know we should draw out the formula but jebus, that's a lot of typing. How about I just link to the formula and show it below?

Retrieved from: [https://en.wikipedia.org/wiki/Okapi\\_BM25](https://en.wikipedia.org/wiki/Okapi_BM25)

$$\text{score}(D, Q) = \sum_{i=1}^n \text{IDF}(q_i) \cdot \frac{f(q_i, D) \cdot (k_1 + 1)}{f(q_i, D) + k_1 \cdot \left(1 - b + b \cdot \frac{|D|}{\text{avgdl}}\right)},$$

4.

Custom Scoring Function: For brevity, only the ids of the top 10 documents are included for each of the following queries using the custom scoring function (see custom method in LuceneSearcher class):

Query: power nap benefits

id: 9fe0ea9205e708269ec2cf437aa23360c5805a8b

id: 31b12608564134c2d86ad73ed53f5ad7997f1caa

id: 76cae6cb9749c647ae52077d6fd535f3ccdb41a2

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id: ce4a8c314abedae1def1b2ae93655f43dc902717  
id: 0bb27470730936e60db6de54836ef6700c58e53f  
id: 1b470a36adea668e666acefd8b82ba1336620315  
id: a39ab68fcfbbaa9baad1533a5b2ea6d0f9bff5744  
id: bf2d3d9fab4e234bcf4ce753f9e99a8c90e9cea9  
id: 0567e33b74e0d52f31987415dc93ed41816bb4cd  
id: 05ee98915108d6fea8b95d4aefd51acadf85bb3a

Query: whale vocalization production of sound

id: 52d1827627d2fdb8271eed24f71a424769595951  
id: fe53859fc48049c4024adff3d175fca54f84b6e4  
id: 35a73dca142e7e4ceb6716d9583b3486e2c19051  
id: 750b53d8441e81fd9f87e3a41dee7c8fdd7be9ca  
id: 72644204bbbed7fe9b443bcf12052684f12c93374  
id: a83dbce81b525478ec6111e959f4e24f0040289f  
id: fbff039e5c107c9f8be00da48add3995428773d7  
id: 064722811a80b660bd940184e7ac3d1629334f39  
id: 44dbf787f368875787080558435c0392b99b8357  
id: 8a370428f3b085e0d11c8c6390aef42536fc7337

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id: 80f928fd3ba87a70411de560d51b93abf2c6bb66  
id: 5df575da5cd13dd1d045119ae9aef434c7875707  
id: d75ff7b28136f10a94889bcdcf2f6c3200dcc3e7f  
id: b8d505b181ac086b69cea67a65ba517491bd34e0  
id: 1513e4cccf389f00cf99bcbe47bcb5dbfe9d5999  
id: 29495dcc618b43427fd2f5920a5dc9decce54049  
id: 3f28912fb9c6b2fa4377414a348275e59b7d90f5  
id: 40beb662b5ec81b519747c14fde3d23e746b7ba5  
id: 4a98bf4038f1cb4bf44e91953a52bd51f6c527aa  
id: 97924bab16d053e96ee70690b893b32559be8fa3