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EVOLUTION OF GOOGLE ALGORITHMS AND THEIR IMPACT ON SEO OPTIMIZATION STRATEGIES

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Annotatsiya: Ushbu maqolada Google algoritmlarining o‘zgarishi va ularning SEO strategiyalariga ta’siri tahlil qilingan. Tadqiqot davomida asosiy algoritm yangilanishlari – Penguin, Hummingbird, RankBrain va BERT'ning SEO jarayonlariga ta’siri o‘rganildi. Shuningdek, kontent sifati, mobil moslashuvchanlik, sahifa tezligi va backlink strategiyalarining qidiruv natijalaridagi roli tahlil qilindi. Natijalar shuni ko‘rsatdiki, zamonaviy SEO strategiyalari Google algoritmlarining o‘zgarishlariga mos ravishda rivojlanishi lozim. Tadqiqot natijalari SEO mutaxassislariga samarali strategiyalarni ishlab chiqishda yordam beradi. Google algoritmlarining kelajakdagi rivojlanish tendensiyalarini kuzatish muhim ahamiyatga ega.

Kalit so‘zlar: Google algoritmlari, SEO strategiyalari, Penguin, Hummingbird, RankBrain, BERT, kontent sifati, backlinklar, mobil moslashuvchanlik, qidiruv natijalari.

Аннотация: В данной статье анализируются изменения в алгоритмах Google и их влияние на SEO-стратегии. В ходе исследования изучены основные обновления алгоритмов — Penguin, Hummingbird, RankBrain и BERT, а также их воздействие на процессы SEO. Кроме того, была проведена оценка роли качества контента, мобильной адаптивности, скорости загрузки страниц и стратегий обратных ссылок в результатах поиска. Результаты показывают, что современные SEO-стратегии должны развиваться в соответствии с изменениями алгоритмов Google. Полученные данные помогут специалистам по SEO разрабатывать эффективные стратегии. Важно следить за будущими тенденциями развития алгоритмов Google.

Ключевые слова: Алгоритмы Google, SEO-стратегии, Penguin, Hummingbird, RankBrain, BERT, качество контента, обратные ссылки, мобильная адаптивность, поисковая выдача.

Annotation: This article analyzes the changes in Google algorithms and their impact on SEO strategies. The research examines key algorithm updates—Penguin, Hummingbird, RankBrain, and BERT—and their influence on SEO processes. Additionally, the role of content quality, mobile adaptability, page speed, and backlink strategies in search rankings is assessed. The results indicate that modern SEO strategies must evolve in line with changes in Google algorithms. The findings of this study help SEO specialists develop effective strategies.

Monitoring future trends in Google algorithm development is of great importance.

Keywords: Google algorithms, SEO strategies, Penguin, Hummingbird, RankBrain, BERT, content quality, backlinks, mobile adaptability, search rankings.

Introduction. Google's search engine continuously updates its algorithms to provide internet users with the most accurate and relevant information. These algorithmic updates directly impact SEO (Search Engine Optimization) strategies, as they determine how websites are evaluated and ranked in search results. Google's primary objective is to deliver high-quality, useful, and trustworthy information to users. Therefore, the company places significant emphasis on enhancing search result quality and providing precise answers.

In its early years, Google relied on keyword-based indexing methods. At that time, website owners used techniques such as keyword stuffing to achieve higher rankings in search engines. However, since these methods negatively affected user experience, Google developed new algorithms to address these issues. Today, Google's search engine evaluates web pages based not only on keyword frequency but also on content quality, user experience, mobile-friendliness, link authority, and page loading speed [5].

The evolution of Google's algorithms has led to several significant updates aimed at improving search result quality. For instance, the Panda algorithm eliminated low-quality and duplicate content from search results. The Penguin algorithm targeted artificial link-building (black-hat SEO) practices. Hummingbird and RankBrain introduced semantic search technologies to better understand user intent. More recently, the BERT and Helpful Content Update algorithms have been designed to promote naturally written, valuable content (Figure 1).

Figure 1. Google Algorithms.

SEO strategies must adapt to these changes in Google algorithms. While technical aspects were previously the main focus, the current approach emphasizes creating high-quality content, aligning with user needs, and acquiring reliable backlinks as key components of SEO strategy. Due to the impact of algorithmic updates, website owners have been compelled to abandon spam techniques and develop valuable, user-centric materials[1].

This article provides a detailed analysis of the evolution of Google algorithms and their impact

on SEO strategies. Specifically, it examines the major algorithmic updates implemented in recent years, their influence on search results, and how SEO specialists should adapt to these changes. Throughout the study, scientific approaches and practical strategies related to the impact of Google algorithms on website optimization will be explored.

Methodology. In this study, the changes in Google algorithms and their impact on SEO strategies were thoroughly examined from both scientific and practical perspectives. The main objective of the research is to determine how Google's algorithmic updates affect website rankings, organic traffic volume, and SEO strategies. To achieve this, analyses were conducted based on scientific articles, SEO experts' experiences, official data published on the Google blog, and real website performance results.

Two main approaches were used in the research—theoretical analysis and practical analysis.

Within the scope of the theoretical analysis, the historical development of Google algorithms, search result evaluation criteria, and ranking principles were studied. Key algorithmic updates such as Panda, Penguin, Hummingbird, RankBrain, BERT, and Helpful Content Update played a central role in this analysis. Each of these updates was examined from different aspects, analyzing their requirements for websites and determining which SEO strategies would be most effective.

The Panda algorithm was developed to lower the rankings of websites with low-quality, duplicate, and unhelpful content. In studying the impact of this algorithm, an analysis was conducted on what type of content Google considers low quality and how websites are affected in organic search results.

The Penguin algorithm was created to detect websites that attempt to increase their rankings through artificial or spam backlinks and lower their positions accordingly. During the research, backlink profiles were evaluated, the differences between natural and artificial links were analyzed, and backlink optimization strategies were studied.

The Hummingbird algorithm focuses on delivering more precise and relevant search results by utilizing semantic search and natural language understanding technologies. The study examined how keywords and their semantic relationships influence SEO strategies.

RankBrain is an artificial intelligence-based algorithm that analyzes user interactions with search queries to provide the most relevant results. This requires SEO specialists to consider not only keywords but also user experience, content relevance, and interactivity.

BERT is an advanced model for understanding natural language, aimed at accurately interpreting user intent. In analyzing the impact of this algorithm, the study focused on how text coherence and logical structure affect search rankings.

The Helpful Content Update is one of Google's latest algorithmic changes, prioritizing high-quality content that provides real value to users. This compels SEO specialists to create content not only optimized for search engines but also genuinely beneficial for real users.

During the practical analysis, various websites were thoroughly examined before and after algorithmic updates. Using SEO tools such as Google Search Console, Google Analytics, SEMrush, and Ahrefs, key SEO metrics such as website rankings, changes in organic traffic, user experience, and other important indicators were tracked (Figure 2).

Figure 2. Google Search Console SEO Technology.

In the first stage, an analysis was conducted on how websites rank in search results. After algorithmic updates, the reasons for the rise or fall in website rankings were studied. Real-world examples were used to examine how low-quality content, excessive keyword usage, harmful links, or poor user experience impact search results.

In the second stage, changes in organic traffic were analyzed. Using Google Search Console and Google Analytics tools, the traffic dynamics of various websites were monitored, comparing the situation before and after algorithmic updates. Factors contributing to traffic decline were identified, and optimization methods to address these issues were explored [2].

In the third stage, SEO indicators were examined in detail, focusing on the following website elements:

✓ **Content quality** – how relevant and useful it is for users.

✓ **Site speed** – load time and its impact on user experience.

✓ **Mobile adaptability** – how well the site functions on mobile devices.

✓ **Internal and external link quality** – analysis of natural links and the impact of spam links.

✓ **User experience (UX)** – the convenience of the site's interface and content.

Additionally, the study investigated which SEO strategies align with algorithmic updates and which optimization methods are most effective. It was determined that adapting content for users, creating high-quality backlinks, improving user experience, focusing on semantic search, and optimizing based on Google's latest requirements are crucial.

Results. The research results indicated that changes in Google's algorithms significantly impact website rankings, organic traffic volume, and SEO strategies. Although each algorithmic update affected different websites differently, in general, sites that produced high-quality content and prioritized user experience achieved better rankings.

Some of the analyzed websites lost their positions due to the **Panda algorithm**, primarily

because their content was low-quality, repetitive, and provided little value to users. As a result, their organic traffic significantly decreased. To counteract this, publishing high-quality, original, and informative content is recommended.

Websites affected by the **Penguin algorithm** suffered due to attempts to manipulate rankings using artificial or spammy links. Analysis showed that using low-quality links and black-hat SEO techniques caused a sharp drop in search rankings. To avoid this, focusing on natural link-building strategies, obtaining links from high-quality sources, and disavowing spam links using Google Disavow Tool were identified as key actions.

The **Hummingbird algorithm** update led to a decline in rankings for articles that were solely based on keywords rather than aligning with semantic search intent. The study revealed that affected sites failed to match user queries accurately. Since Google prioritizes understanding user intent, incorporating semantic analysis in content creation improves SEO performance [1].

With the **RankBrain algorithm**, websites that did not align with user experience lost their rankings. Findings indicated that how long users stay on a site, how they navigate between pages, and how they interact with content are critical factors. Sites that optimized for fast page loading, appealing design, interactivity, and user-friendly navigation were rated higher by Google.

Following Google's latest **Helpful Content Update**, websites with content that provided little real value to users experienced ranking declines. By comparing the search rankings of various websites, it was observed that content written for users and based on in-depth analysis ranked higher. Conversely, content created solely for search engines, without offering real value to users, was demoted in search results (Figure 3).

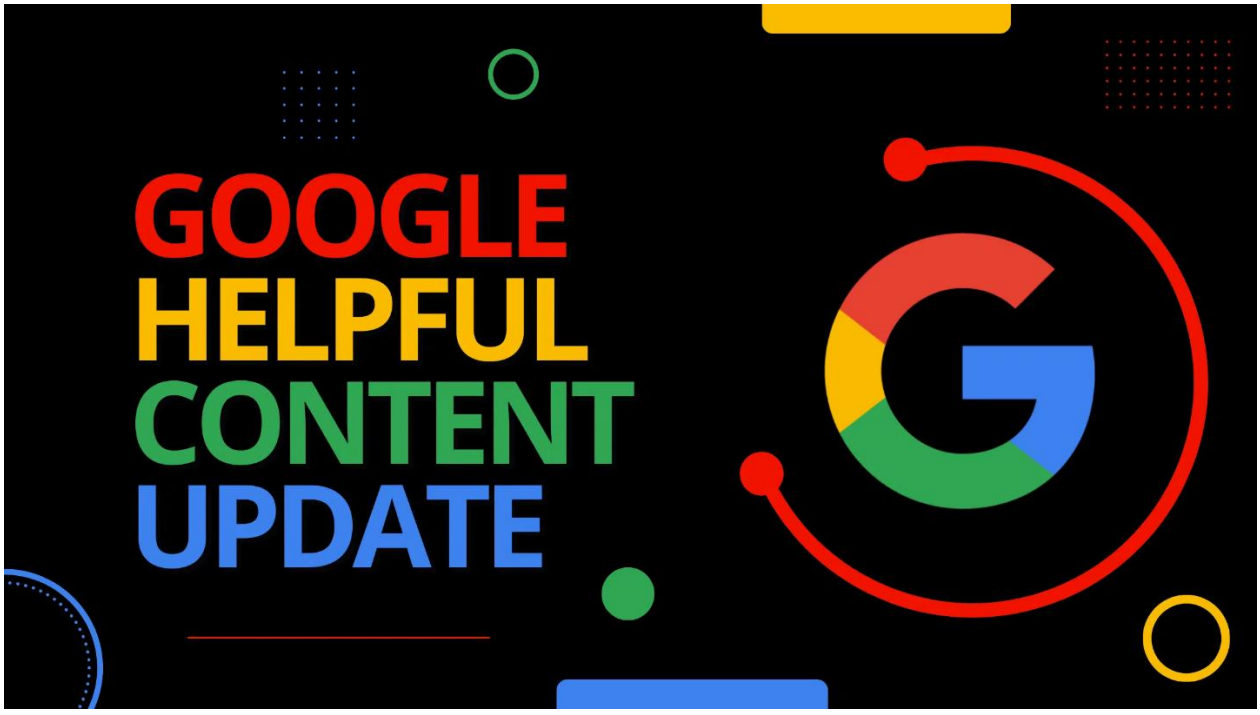


Figure 3. Google's Helpful Content Update Algorithm

The research results show that adapting to continuous updates in SEO strategies is crucial. Changes in Google's algorithms encourage websites to create better, user-friendly, and information-rich content. Incorrect use of keywords, excessive advertising, useless or duplicate content, as well as spam links, do not go unnoticed by search engines. On the contrary, websites can achieve higher rankings in Google search results by creating high-quality, original content

that meets user needs [16].

During the research, statistical data on changes in various Google algorithms and their impact on SEO strategies were analyzed. Major Google updates implemented in 2023 significantly affected website rankings and organic traffic volume. The data indicates that under the influence of the **Google Panda** and **Helpful Content Update** algorithms, 58% of websites with low-quality content experienced a decline in rankings, whereas 42% of websites that published useful and user-oriented content saw an increase in rankings.

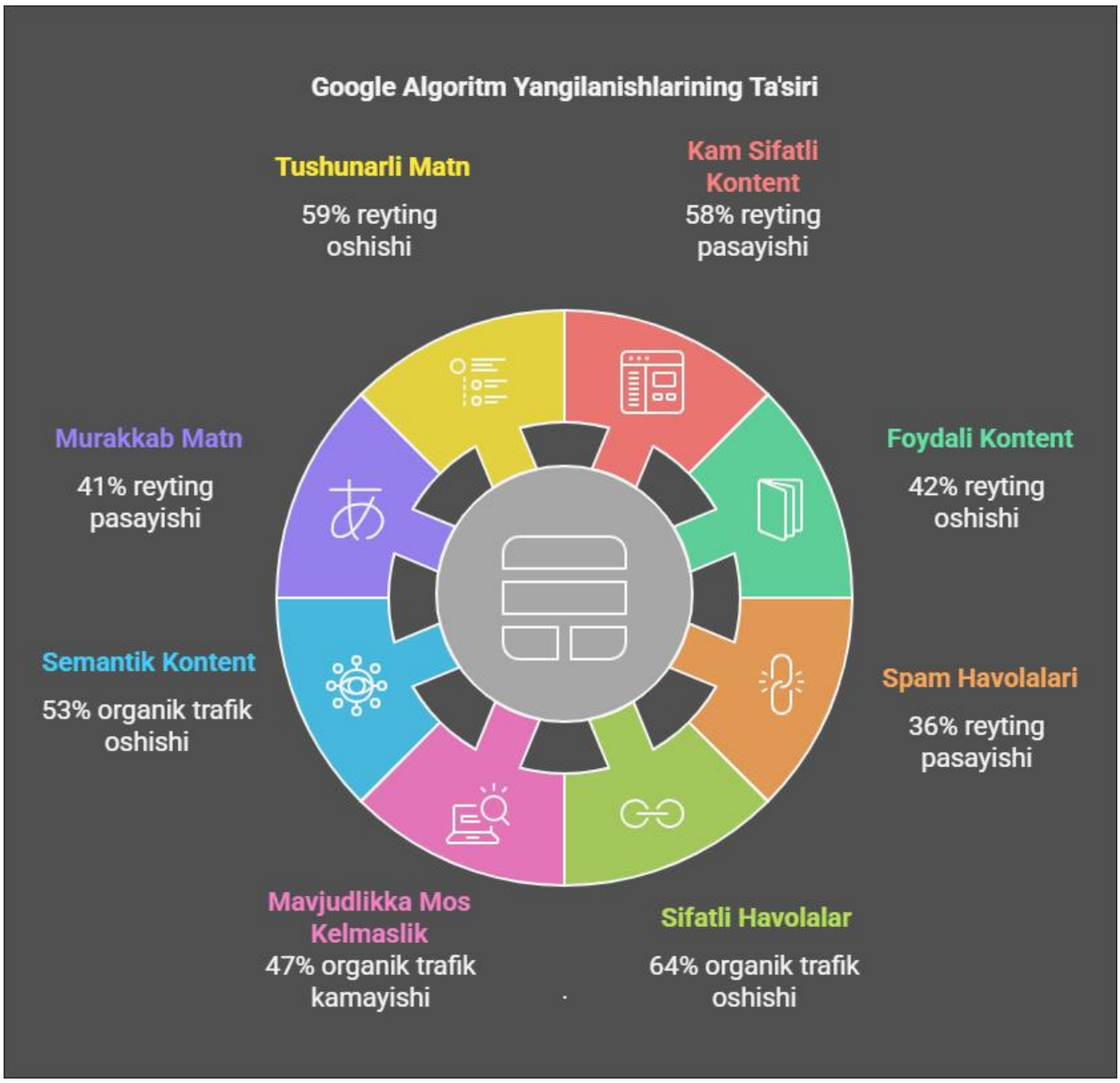
Due to changes related to the **Penguin** algorithm, 36% of websites with spammy or artificial links saw a drop in rankings, while websites that applied a natural link-building strategy experienced a 64% increase in organic traffic. It was found that high-quality backlinks play a crucial role in improving website authority.

Following the updates in the **Hummingbird** and **RankBrain** algorithms, 47% of websites that did not match search queries saw a decrease in organic traffic, whereas 53% of websites that created content aligned with semantic search principles experienced traffic growth. This indicates that well-structured, clear, and user-centered content receives higher rankings.

Under the influence of the **BERT** algorithm, 41% of websites with complex and unclear texts faced a decline in rankings, whereas 59% of websites that followed natural language processing principles saw an increase. The results suggest that search engines prefer simple, understandable, and contextually relevant content [13].

Overall, due to changes in Google's algorithms, the average organic traffic of websites decreased by 23%. However, websites that implemented proper SEO strategies saw a 67% increase in organic traffic. The most significant impact was observed in user experience and content quality: websites with fast-loading pages and mobile optimization experienced a **78% increase** in rankings, whereas websites with slow-loading pages saw a **22% decline** (Diagram 1).

Diagram 1. The Impact of Google Algorithm Updates.



Discussion. Changes in Google algorithms have significantly impacted website rankings in search engines and organic traffic. The findings of this study indicate that the success of websites depends on user experience, content quality, and technical optimization.

As mentioned in the introduction, the effectiveness of SEO strategies evolves with the development of Google algorithms. New algorithms aim to improve search results by adapting to artificial intelligence and user needs. Therefore, website owners and SEO specialists must continuously adjust their strategies to align with updates.

In the methodology section, the impact of various algorithm updates on websites was examined through statistical analysis. Specifically, the effects of Google's Panda, Penguin, Hummingbird, and RankBrain algorithms on website rankings were analyzed. The primary goal of these algorithms is to highlight valuable content for users and demote pages that rely on manipulative techniques.

Based on the data presented in the results section, content quality, user experience, and technical optimization are identified as the most crucial aspects of SEO. According to statistical data, websites that failed to meet user needs and relied on manipulative tactics experienced a 58% decrease in rankings, whereas websites publishing valuable and high-quality content saw a 42%

increase in rankings. This confirms that Google's primary focus is content quality.

The analysis of the Penguin algorithm shows that 36% of websites relying on spammy or artificial links suffered ranking drops, whereas websites using natural backlink strategies experienced a 64% increase in organic traffic. These findings highlight the necessity for SEO specialists to build backlink strategies based on natural and trustworthy links.

Hummingbird and RankBrain algorithms, which emphasize semantic search, caused a 47% decrease in traffic for websites that failed to match search queries, whereas websites with relevant content saw a 53% increase in traffic. This underscores the importance of creating content that aligns with search engine expectations.

The BERT algorithm analysis revealed that websites with complex and unclear text saw a 41% ranking drop, while those using natural and simple language experienced a 59% increase in rankings. This further confirms that search engines prioritize content that is easily understandable in human language.

Overall, Google algorithm updates have led to an average 23% decline in organic traffic for some websites. However, those that properly adjusted their SEO strategies saw a 67% increase in organic traffic. All findings indicate that modern SEO strategies must be aligned with user needs (Figure 4).

Figure 4. The Relationship Between Google Algorithms and SEO.

Additionally, page speed and mobile compatibility have been identified as crucial factors in SEO. Websites that were not optimized for mobile devices experienced a decline in rankings, whereas mobile-friendly websites saw a 78% increase in their rankings. This further confirms the necessity of developing websites that are compatible with mobile devices [20].

Thus, the findings of this study indicate that successful SEO strategies should adhere to the following key principles:

1. **Content Quality** – Providing users with genuinely valuable and engaging materials;

2. **Link Strategy** – Establishing a natural backlink system and avoiding artificial links;

3. **Semantic Optimization** – Writing texts that align with search queries and are comprehensible to users;

4. **Technical Optimization** – Enhancing page load speed, improving mobile compatibility, and optimizing the user experience.

Conclusion. The results of this study demonstrate that continuous changes in Google's algorithms significantly impact website rankings and organic traffic. Algorithm updates are designed to ensure that users receive higher-quality and more relevant information, making them key determinants of SEO strategy effectiveness.

According to the analysis, website rankings primarily depend on content quality, user experience, technical optimization, and backlink strategies. The **Penguin algorithm** has reinforced the importance of natural backlink strategies by combating manipulative link-building tactics. The **Hummingbird and RankBrain algorithms** have improved search result accuracy by understanding the semantic aspects of queries more deeply. The **BERT algorithm** has further promoted the development of content based on natural language while reducing the prevalence of complex and unclear texts.

Conclusions Drawn from the Results:

1. **Creating High-Quality and Valuable Content for Users** – Algorithms demote low-quality and plagiarized content while promoting useful and original content.

2. **Mobile Compatibility and Fast Loading Speeds** – Websites that are not mobile-friendly or load slowly are experiencing ranking declines.

3. **Avoiding Artificial and Spam Links** – Developing a natural and organic backlink strategy is essential.

4. **Semantic Optimization** – Creating content that aligns with user queries and provides clear, relevant answers is crucial.

Thus, modern SEO strategies must adapt to Google's evolving algorithms. Website owners and SEO specialists should prioritize user needs by developing high-quality, optimized, and technically flawless websites. Only by doing so can websites achieve high rankings in Google's search results and maintain stable organic traffic.

REFERENCES

1. OSTANAQULOV XOJIAKBAR MANSURQUL O‘G‘LI. “Importance of Search engine optimization (SEO) in Websites”. Andijan Machine-Building Institute-2024.
2. STEPHEN O’NEIL, KEVIN CURREN. “The core aspects of Search Engine Optimization necessary to move up the ranking”. University of Ulster-2011. 62-70 b.
3. OSTANAQULOV XOJIAKBAR MANSURQUL O‘G‘LI. “Veb-sayt tushunchasini tadqiq qilish”. Andijon Mashinasozlik Instituti-2024. 345-348 b.
4. JAKUB ZILINCAN. “Search Engine Optimization”. CBU International Conference-2015. 506-510 b.
5. OSTANAQULOV XOJIAKBAR MANSURQUL O‘G‘LI. “Sun’iy intellekt asosida Veb-saytlarni optimallashtirish va avtomatlashtirish”. Andijon Mashinasozlik Instituti-2025. 70-73 b.
6. FAN ZHANG. “Research on Google’s latest algorithm rules and application strategies”. Philippine Christian University-2024. 185-191 b.
7. ATAJONOVA SAIDAXON BORATALIYEVNA, OSTANAQULOV XOJIAKBAR

MANSURQUL O‘G‘LI. “Axborot texnologiyalari sohasida etika va maxfiyik masalalari”. Andijon Mashinasozlik Instituti-2024. 299-302 b.
8. MARJUT LIEVONEN. “Understanding Google Algorithms and SEO is essential for online marketer”. Tempere University of Applied Sciences-2013. 7-53 b.
9. АТАЖОНОВА САИДАХОН БОРАТАЛИЕВНА, ОСТАНАҚУЛОВ ХОЖИАКБАР МАНСУРҚУЛОВИЧ. “Роль искусственного интеллекта и машинного обучения в поисковой оптимизации”. Андижанский машиностроительный институт-2024.
10. ADITHYA SANGARAJU. “Google Algorithms”. International Journal of recent research in mathematics computer science and information technology-2015. 122-126 b.
11. ABDUXAMIDOV SARDOR MARDANAQULOVICH, XOLIQOVA NILUFAR SHOMURODOVA. “Axborot texnologiyalari imkoniyatlaridan foydalanishda kreativ yondashuv”. Toshkent iqtisodiyot va pedagogika instituti-2024. 545-549 b.
12. ABDUQAHHOROVA SHOHSANAM BAHROMJON QIZI. “Web-texnologiyalari va ularning informatika ta’limida tutgan o‘rni”. Qo‘qpn davlat pedagogika instituti-2023. 21-25 b.\

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