**ПРАВИТЕЛЬСТВО РОССИЙСКОЙ ФЕДЕРАЦИИ**

**ФЕДЕРАЛЬНОЕ ГОСУДАРСТВЕННОЕ АВТОНОМНОЕ**

**ОБРАЗОВАТЕЛЬНОЕ УЧРЕЖДЕНИЕ ВЫСШЕГО ОБРАЗОВАНИЯ**

**НАЦИОНАЛЬНЫЙ ИССЛЕДОВАТЕЛЬСКИЙ УНИВЕРСИТЕТ**

**«ВЫСШАЯ ШКОЛА ЭКОНОМИКИ»**

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Образовательная программа «Программная инженерия»

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«\_\_\_» \_\_\_\_\_\_\_\_\_\_\_\_\_ 2022 г. «\_\_\_» \_\_\_\_\_\_\_\_\_\_\_\_\_ 2022 г.

**ПРОГРАММА ВИЗУАЛИЗАЦИИ АЛГОРИТМОВ И СТРУКТУР ДАННЫХ**

**Текст программы**

**ЛИСТ УТВЕРЖДЕНИЯ**

**RU.17701729.10.03-01 12 01-1-ЛУ**

Исполнитель студент группы БПИ203 \_\_\_\_\_\_\_\_\_ / П.Н.Ломакин/

«\_\_\_» \_\_\_\_\_\_\_\_\_\_\_ 2022 г.

УТВЕРЖДЕН

RU.17701729.10.03-01 12 01-1-ЛУ

**ПРОГРАММА ВИЗУАЛИЗАЦИИ АЛГОРИТМОВ И СТРУКТУР ДАННЫХ**

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**RU.17701729.10.03-01 12 01-1-ЛУ**

# 

**Листов 53**

# **ТЕКСТ ПРОГРАММЫ**

Данное приложение написано на языке JavaScript, использована среда разработки Visual Studio Code.

Программа состоит из 6 файлов расширения .js, 1 файла расширения .html и 4 файлов расширения .css. В данном документе описано содержимое данных файлов.

* 1. **Файлы расширения .js**
     1. **Файл bloom.js**

1. let filterSize, numberOfHash;
2. let visualizationInProcess = false;
3. function addEventWhenButtonBuildFilterWasClicked(buttonBuildFilter, inputFilterSize, inputNumberOfHash) {
4. buttonBuildFilter.addEventListener('click', () => {
5. if (visualizationInProcess) {
6. return;
7. }
8. inputFilterSize.addEventListener('click', () => {
9. if (inputFilterSize.style.borderColor == "red") {
10. inputFilterSize.value = "";
11. inputFilterSize.style.borderColor = "";
12. }
13. });
14. inputNumberOfHash.addEventListener('click', () => {
15. if (inputNumberOfHash.style.borderColor == "red") {
16. inputNumberOfHash.value = "";
17. inputNumberOfHash.style.borderColor = "";
18. }
19. });
20. let dontBuildFilter = false;
21. if (isFloat(parseFloat(inputFilterSize.value)) || !(Number.isInteger(parseInt(inputFilterSize.value)) && parseInt(inputFilterSize.value) <= 13 && parseInt(inputFilterSize.value) >= 1)) {
22. inputFilterSize.style.borderColor = "red";
23. dontBuildFilter = true;
24. }
25. if (isFloat(parseFloat(inputNumberOfHash.value)) || !(Number.isInteger(parseInt(inputNumberOfHash.value)) && parseInt(inputNumberOfHash.value) <= 13 && parseInt(inputNumberOfHash.value) >= 1)) {
26. inputNumberOfHash.style.borderColor = "red";
27. dontBuildFilter = true;
28. }
29. if (dontBuildFilter) {
30. // Reset the main playground.
31. document.getElementById('playground-main').innerHTML = '';
32. let playgroundMainTitle = document.createElement('div');
33. playgroundMainTitle.className = 'playground-main-title';
34. playgroundMainTitle.id = 'playground-main-title';
35. playgroundMainTitle.innerHTML = "playground";
36. document.getElementById('playground-main').appendChild(playgroundMainTitle);
37. return;
38. }
39. if (Number.isInteger(parseInt(inputFilterSize.value)) && parseInt(inputFilterSize.value) <= 13 && parseInt(inputFilterSize.value) >= 1 &&
40. Number.isInteger(parseInt(inputNumberOfHash.value)) && parseInt(inputNumberOfHash.value) <= 13 && parseInt(inputNumberOfHash.value) >= 1) {
42. filterSize = parseInt(inputFilterSize.value);
43. numberOfHash = parseInt(inputNumberOfHash.value);
44. document.getElementById('pseudocode-window').innerHTML = "";
45. let pseudocodeTitle = document.createElement('div');
46. pseudocodeTitle.className = 'pseudocode-titile';
47. pseudocodeTitle.id = 'pseudocode-titile';
48. pseudocodeTitle.innerHTML = 'CODE';
49. document.getElementById('pseudocode-window').appendChild(pseudocodeTitle);
50. // Reset the main playground.
51. document.getElementById('playground-main').innerHTML = '';
52. // Creating shell for filter.
53. createFilterArray();
54. // Creating shell for hash functions.
55. createHashFunctions();
56. buildBloomFilter(filterSize);
57. createZoneForBarChart();
58. // Elements to be added to the bloom filter.
59. let addedElementsList = [];
60. // Creating universal hash functions.
61. let hashFunctions = new UniversalHashFunctions(numberOfHash).generateFunctions();
62. createChangeFunctionParametersElements();
63. document.getElementById('accespt-changes-to-function-button').onclick = () => {
64. if (!visualizationInProcess) {
65. if (!(document.getElementById('number-of-function-to-change-input').value == "" || document.getElementById('a-parameter-to-change-input').value == "" ||
66. document.getElementById('b-parameter-to-change-input').value == "" || document.getElementById('p-parameter-to-change-input').value == "" ||
67. document.getElementById('number-of-function-to-change-input').style.borderColor == "red" || document.getElementById('a-parameter-to-change-input').style.borderColor == "red" ||
68. document.getElementById('b-parameter-to-change-input').style.borderColor == "red" || document.getElementById('p-parameter-to-change-input').style.borderColor == "red")) {
69. let numberOfFunction = parseInt(document.getElementById('number-of-function-to-change-input').value);
70. let parameterA = parseInt(document.getElementById('a-parameter-to-change-input').value);
71. let parameterB = parseInt(document.getElementById('b-parameter-to-change-input').value);
72. let parameterP = parseInt(document.getElementById('p-parameter-to-change-input').value);
73. document.getElementById('number-of-function-to-change-input').value = "";
74. document.getElementById('a-parameter-to-change-input').value = "";
75. document.getElementById('b-parameter-to-change-input').value = "";
76. document.getElementById('p-parameter-to-change-input').value = "";
77. let newFunction = value => {
78. return [(parameterA \* value + parameterB) % parameterP, parameterA, parameterB, parameterP];
79. }
80. hashFunctions[numberOfFunction - 1] = newFunction;
81. buildListOfHashFunctions(numberOfHash, hashFunctions, filterSize);
82. }
83. }
84. }
85. document.getElementById('change-parameters-of-function-randomly').onclick = () => {
86. if (!visualizationInProcess) {
87. if (document.getElementById('number-of-function-to-change-input').value != "" &&
88. document.getElementById('number-of-function-to-change-input').style.borderColor != "red") {
89. let numberOfFunction = parseInt(document.getElementById('number-of-function-to-change-input').value);
90. let parameterP = Math.floor(Math.random() \* (100000) + 1);
91. let parameterA = Math.floor(Math.random() \* (parameterP - 1) + 1);
92. let parameterB = Math.floor(Math.random() \* parameterP);
93. document.getElementById('number-of-function-to-change-input').value = "";
94. document.getElementById('a-parameter-to-change-input').value = "";
95. document.getElementById('b-parameter-to-change-input').value = "";
96. document.getElementById('p-parameter-to-change-input').value = "";
97. let newFunction = value => {
98. return [(parameterA \* value + parameterB) % parameterP, parameterA, parameterB, parameterP];
99. }
100. hashFunctions[numberOfFunction - 1] = newFunction;
101. buildListOfHashFunctions(numberOfHash, hashFunctions, filterSize);
102. }
103. }
104. }
105. buildListOfHashFunctions(numberOfHash, hashFunctions, filterSize);
106. createButtonAddElement();
107. createInputAddElement();
108. createButtonCheckElementAvailability();
109. createShowAddedElementsButton();
110. // After clicking button 'buttonClearFilter' all elements from
111. // filter would be deleted.
112. let buttonClearFilter = createButtonClearFilter();
113. buttonClearFilter.onclick = () => {
114. if (!visualizationInProcess) {
115. addedElementsList = [];
116. document.getElementById('text-area-with-list-of-added-elements').innerHTML = "";
117. let filterCells = document.getElementById('filter-array-div').childNodes;
118. for (let cell of filterCells) {
119. cell.firstChild.innerHTML = '0';
120. cell.classList.remove('highlighted');
121. }
122. }
123. }
124. document.getElementById('add-element-button').onclick = () => {
125. if (!visualizationInProcess) {
126. if (document.getElementById('add-element-input').style.borderColor != "red" && document.getElementById('add-element-input').value != "") {
127. if (!addedElementsList.includes(parseInt(document.getElementById('add-element-input').value))) {
128. addedElementsList.push(parseInt(document.getElementById('add-element-input').value));
129. document.getElementById('text-area-with-list-of-added-elements').innerHTML +=
130. addedElementsList.length + ": " + parseInt(document.getElementById('add-element-input').value) + "\n";
131. }
132. changeValuesInCellsAfterAddingElement(hashFunctions, filterSize);
133. }
134. }
135. }
136. document.getElementById('check-element-availability-button').onclick = () => {
137. if (!visualizationInProcess) {
138. if (document.getElementById('add-element-input').style.borderColor != "red" && document.getElementById('add-element-input').value != "") {
139. checkElementAvailability(hashFunctions, addedElementsList);
140. }
141. }
142. }
143. }
144. });
145. }
146. function createButtonClearFilter() {
147. let buttonClearFilter = document.createElement('button');
148. buttonClearFilter.className = "button-clear-filter";
149. buttonClearFilter.id = "button-clear-filter";
150. buttonClearFilter.innerHTML = "Clear filter";
151. buttonClearFilter.style.background = "background-color: rgb(98, 80, 57);"
152. document.getElementById('playground-main').appendChild(buttonClearFilter);
153. return buttonClearFilter;
154. }
155. function isFloat(n){
156. return Number(n) === n && n % 1 !== 0;
157. }
158. /\*\*
159. \* Сreates a zone in which the fields for entering
160. \* input data for the bloom filter will be located.
161. \*/
162. function createZoneForBarChart() {
163. // Div where input elements and chart would be located.
164. let zoneForBarChart = document.createElement('div');
165. zoneForBarChart.id = 'zone-for-bar-chart';
166. zoneForBarChart.className = 'zone-for-bar-chart';
167. document.getElementById('playground-main').appendChild(zoneForBarChart);
168. // Button that shows all input elements for bar chart and chart.
169. let showZoneForBatChartButton = document.createElement('button');
170. showZoneForBatChartButton.className = "show-zone-bar-chart-button";
171. showZoneForBatChartButton.id = "show-zone-bar-chart-button";
172. showZoneForBatChartButton.innerHTML = "Input data analysis";
173. zoneForBarChart.appendChild(showZoneForBatChartButton);
174. let labelForFilterSizeBarChart = document.createElement('label');
175. labelForFilterSizeBarChart.style.position = 'absolute';
176. labelForFilterSizeBarChart.style.top = '34px';
177. labelForFilterSizeBarChart.innerHTML = "Filter Bloom size:";
178. labelForFilterSizeBarChart.classList.add('hide-element');
179. labelForFilterSizeBarChart.style.fontStyle = "italic";
180. zoneForBarChart.appendChild(labelForFilterSizeBarChart);
181. // Input for filter size for bar chart.
182. let inputFilterSizeForBarChart = document.createElement('input');
183. inputFilterSizeForBarChart.className = 'input-filter-size-for-bar-chart';
184. inputFilterSizeForBarChart.id = 'input-filter-size-for-bar-chart';
185. inputFilterSizeForBarChart.classList.add('hide-element');
186. inputFilterSizeForBarChart.placeholder = "your number";
187. zoneForBarChart.appendChild(inputFilterSizeForBarChart);
188. inputFilterSizeForBarChart.onblur = () => {
189. if (inputFilterSizeForBarChart.value != "" && (isFloat(parseFloat(inputFilterSizeForBarChart.value)) ||
190. !Number.isInteger(parseInt(inputFilterSizeForBarChart.value)) ||
191. String(parseInt(inputFilterSizeForBarChart.value)).length > 16 || parseInt(inputFilterSizeForBarChart.value) < 1) && inputFilterSizeForBarChart.style.borderColor != "red") {
192. inputFilterSizeForBarChart.style.borderColor = "red";
193. }
194. }
195. inputFilterSizeForBarChart.addEventListener('click', () => {
196. if (inputFilterSizeForBarChart.style.borderColor == "red") {
197. inputFilterSizeForBarChart.style.borderColor = "";
198. inputFilterSizeForBarChart.value = "";
199. }
200. });
201. let labelNumberOfHashFunctionsForBarChart = document.createElement('label');
202. labelNumberOfHashFunctionsForBarChart.style.position = 'absolute';
203. labelNumberOfHashFunctionsForBarChart.style.top = '78px';
204. labelNumberOfHashFunctionsForBarChart.innerHTML = "Number of hash functions:";
205. labelNumberOfHashFunctionsForBarChart.classList.add('hide-element');
206. labelNumberOfHashFunctionsForBarChart.style.fontStyle = "italic";
207. zoneForBarChart.appendChild(labelNumberOfHashFunctionsForBarChart);
208. // Input for number of hash functions for bar chart.
209. let inputNumberOfHashForBarChart = document.createElement('input');
210. inputNumberOfHashForBarChart.className = 'input-number-of-hash-functions-for-bar-chart';
211. inputNumberOfHashForBarChart.id = 'input-number-of-hash-functions-for-bar-chart';
212. inputNumberOfHashForBarChart.classList.add('hide-element');
213. inputNumberOfHashForBarChart.placeholder = "your number";
214. zoneForBarChart.appendChild(inputNumberOfHashForBarChart);
215. inputNumberOfHashForBarChart.onblur = () => {
216. if (inputNumberOfHashForBarChart.value != "" && (isFloat(parseFloat(inputNumberOfHashForBarChart.value)) ||
217. !Number.isInteger(parseInt(inputNumberOfHashForBarChart.value)) ||
218. String(parseInt(inputNumberOfHashForBarChart.value)).length > 16 || parseInt(inputNumberOfHashForBarChart.value) < 1) && inputNumberOfHashForBarChart.style.borderColor != "red") {
219. inputNumberOfHashForBarChart.style.borderColor = "red";
220. }
221. }
222. inputNumberOfHashForBarChart.addEventListener('click', () => {
223. if (inputNumberOfHashForBarChart.style.borderColor == "red") {
224. inputNumberOfHashForBarChart.style.borderColor = "";
225. inputNumberOfHashForBarChart.value = "";
226. }
227. });
228. let labelNumberOfElementsToAdd = document.createElement('label');
229. labelNumberOfElementsToAdd.style.position = 'absolute';
230. labelNumberOfElementsToAdd.style.top = '123px';
231. labelNumberOfElementsToAdd.innerHTML = "Number of elements to add:";
232. labelNumberOfElementsToAdd.classList.add('hide-element');
233. labelNumberOfElementsToAdd.style.fontStyle = "italic";
234. zoneForBarChart.appendChild(labelNumberOfElementsToAdd);
235. // Input number of elements to add to filter for bar chart.
236. let inputNumberOfElementsToAddForBarChart = document.createElement('input');
237. inputNumberOfElementsToAddForBarChart.className = 'input-number-of-elements-to-add-for-bar-chart';
238. inputNumberOfElementsToAddForBarChart.id = 'input-number-of-elements-to-add-for-bar-chart';
239. inputNumberOfElementsToAddForBarChart.classList.add('hide-element');
240. inputNumberOfElementsToAddForBarChart.placeholder = "your number";
241. zoneForBarChart.appendChild(inputNumberOfElementsToAddForBarChart);
242. inputNumberOfElementsToAddForBarChart.onblur = () => {
243. if (inputNumberOfElementsToAddForBarChart.value != "" && (isFloat(parseFloat(inputNumberOfElementsToAddForBarChart.value)) ||
244. !Number.isInteger(parseInt(inputNumberOfElementsToAddForBarChart.value)) ||
245. String(parseInt(inputNumberOfElementsToAddForBarChart.value)).length > 16 || parseInt(inputNumberOfElementsToAddForBarChart.value) < 1) &&
246. inputNumberOfElementsToAddForBarChart.style.borderColor != "red") {
247. inputNumberOfElementsToAddForBarChart.style.borderColor = "red";
248. }
249. }
250. inputNumberOfElementsToAddForBarChart.addEventListener('click', () => {
251. if (inputNumberOfElementsToAddForBarChart.style.borderColor == "red") {
252. inputNumberOfElementsToAddForBarChart.style.borderColor = "";
253. inputNumberOfElementsToAddForBarChart.value = "";
254. }
255. });
256. let labelNumberOfElementsToCheck = document.createElement('label');
257. labelNumberOfElementsToCheck.style.position = 'absolute';
258. labelNumberOfElementsToCheck.style.top = '167px';
259. labelNumberOfElementsToCheck.innerHTML = "Number of elements to check:";
260. labelNumberOfElementsToCheck.classList.add('hide-element');
261. labelNumberOfElementsToCheck.style.fontStyle = "italic";
262. zoneForBarChart.appendChild(labelNumberOfElementsToCheck);
263. // Input number of elements to check avaliability in filter for bar chart.
264. let inputNumberOfElementsToCheckForBarChart = document.createElement('input');
265. inputNumberOfElementsToCheckForBarChart.className = 'input-number-of-elements-to-check-for-bar-chart';
266. inputNumberOfElementsToCheckForBarChart.id = 'input-number-of-elements-to-check-for-bar-chart';
267. inputNumberOfElementsToCheckForBarChart.classList.add('hide-element');
268. inputNumberOfElementsToCheckForBarChart.placeholder = "your number";
269. zoneForBarChart.appendChild(inputNumberOfElementsToCheckForBarChart);
270. inputNumberOfElementsToCheckForBarChart.onblur = () => {
271. if (inputNumberOfElementsToCheckForBarChart.value != "" && (isFloat(parseFloat(inputNumberOfElementsToCheckForBarChart.value)) ||
272. !Number.isInteger(parseInt(inputNumberOfElementsToCheckForBarChart.value)) ||
273. String(parseInt(inputNumberOfElementsToCheckForBarChart.value)).length > 16 || parseInt(inputNumberOfElementsToCheckForBarChart.value) < 1) &&
274. inputNumberOfElementsToCheckForBarChart.style.borderColor != "red") {
275. inputNumberOfElementsToCheckForBarChart.style.borderColor = "red";
276. }
277. }
278. inputNumberOfElementsToCheckForBarChart.addEventListener('click', () => {
279. if (inputNumberOfElementsToCheckForBarChart.style.borderColor == "red") {
280. inputNumberOfElementsToCheckForBarChart.style.borderColor = "";
281. inputNumberOfElementsToCheckForBarChart.value = "";
282. }
283. });
284. let labelNumbersRange = document.createElement('label');
285. labelNumbersRange.style.position = 'absolute';
286. labelNumbersRange.style.top = '210px';
287. labelNumbersRange.innerHTML = "Range for elements:";
288. labelNumbersRange.classList.add('hide-element');
289. labelNumbersRange.style.fontStyle = "italic";
290. zoneForBarChart.appendChild(labelNumbersRange);
291. // Input left border for number for bar chart
292. let inputLeftBorderForNumbers = document.createElement('input');
293. inputLeftBorderForNumbers.className = 'input-left-border-number-for-bar-chart';
294. inputLeftBorderForNumbers.id = 'input-left-border-number-for-bar-chart';
295. inputLeftBorderForNumbers.classList.add('hide-element');
296. inputLeftBorderForNumbers.placeholder = "left border";
297. zoneForBarChart.appendChild(inputLeftBorderForNumbers);
298. inputLeftBorderForNumbers.onblur = () => {
299. if (inputLeftBorderForNumbers.value != "" && (isFloat(parseFloat(inputLeftBorderForNumbers.value)) ||
300. !Number.isInteger(parseInt(inputLeftBorderForNumbers.value)) ||
301. String(parseInt(inputLeftBorderForNumbers.value)).length > 16 || parseInt(inputLeftBorderForNumbers.value) < 0) &&
302. inputLeftBorderForNumbers.style.borderColor != "red") {
303. inputLeftBorderForNumbers.style.borderColor = "red";
304. }
305. }
306. inputLeftBorderForNumbers.addEventListener('click', () => {
307. if (inputLeftBorderForNumbers.style.borderColor == "red") {
308. inputLeftBorderForNumbers.style.borderColor = "";
309. inputLeftBorderForNumbers.value = "";
310. }
311. });
312. // Input right border for number for bar chart
313. let inputRightBorderForNumbers = document.createElement('input');
314. inputRightBorderForNumbers.className = 'input-right-border-number-for-bar-chart';
315. inputRightBorderForNumbers.id = 'input-right-border-number-for-bar-chart';
316. inputRightBorderForNumbers.classList.add('hide-element');
317. inputRightBorderForNumbers.placeholder = "right border";
318. zoneForBarChart.appendChild(inputRightBorderForNumbers);
319. inputRightBorderForNumbers.onblur = () => {
320. if (inputRightBorderForNumbers.value != "" && (isFloat(parseFloat(inputRightBorderForNumbers.value)) ||
321. !Number.isInteger(parseInt(inputRightBorderForNumbers.value)) ||
322. String(parseInt(inputRightBorderForNumbers.value)).length > 16) &&
323. inputRightBorderForNumbers.style.borderColor != "red") {
324. inputRightBorderForNumbers.style.borderColor = "red";
325. }
326. }
327. inputRightBorderForNumbers.addEventListener('click', () => {
328. if (inputRightBorderForNumbers.style.borderColor == "red") {
329. inputRightBorderForNumbers.style.borderColor = "";
330. inputRightBorderForNumbers.value = "";
331. }
332. });
333. // After clicking this button bar chart would be redrawing.
334. let generateBloomFilterForBarChartButton = document.createElement('button');
335. generateBloomFilterForBarChartButton.className = 'button-to-build-filter-bar-chart';
336. generateBloomFilterForBarChartButton.id = 'button-to-build-filter-bar-chart';
337. generateBloomFilterForBarChartButton.classList.add('hide-element');
338. generateBloomFilterForBarChartButton.innerHTML = 'generate';
339. zoneForBarChart.appendChild(generateBloomFilterForBarChartButton);
340. let barChart = createBarChart(0, 0, 0);
341. generateBloomFilterForBarChartButton.onclick = () => {
342. if (!(inputFilterSizeForBarChart.value == "" || inputNumberOfHashForBarChart.value == "" ||
343. inputNumberOfElementsToAddForBarChart.value == "" || inputNumberOfElementsToCheckForBarChart.value == "" ||
344. inputLeftBorderForNumbers.value == "" || inputRightBorderForNumbers.value == "" ||
345. inputFilterSizeForBarChart.style.borderColor == "red" || inputNumberOfHashForBarChart.style.borderColor == "red" ||
346. inputNumberOfElementsToAddForBarChart.style.borderColor == "red" || inputNumberOfElementsToCheckForBarChart.style.borderColor == "red" ||
347. inputLeftBorderForNumbers.style.borderColor == "red" || inputRightBorderForNumbers.style.borderColor == "red" ||
348. parseInt(inputLeftBorderForNumbers.value) > parseInt(inputRightBorderForNumbers.value))) {
349. let numberOfFalsePositive, numberOfNegative, numberOfPositive;
350. [numberOfFalsePositive, numberOfNegative, numberOfPositive] = getresultsFromBloomFilterForBarChart(inputFilterSizeForBarChart.value, inputNumberOfHashForBarChart.value,
351. inputNumberOfElementsToAddForBarChart.value, inputNumberOfElementsToCheckForBarChart.value);
352. barChart.destroy();
353. barChart = createBarChart(numberOfFalsePositive, numberOfNegative, numberOfPositive);
354. if (document.getElementById('barChart').style.display == "none") {
355. document.getElementById('barChart').style.display = "block";
356. }
357. }
358. }
359. let labelExplainingBarChart = document.createElement('label');
360. labelExplainingBarChart.style.position = 'absolute';
361. labelExplainingBarChart.style.top = '300px';
362. labelExplainingBarChart.innerHTML = "First, a filter is created, after which randomly generated numbers are added to it, the number of which is equal to the value in the third field.<br><br>After that, new numbers are randomly generated (their number is equal to the value in the fourth field), which are checked for belonging to the filter.";
363. labelExplainingBarChart.style.fontStyle = "italic";
364. labelExplainingBarChart.classList.add('hide-element');
365. zoneForBarChart.appendChild(labelExplainingBarChart);
366. showZoneForBatChartButton.onclick = () => {
367. inputRightBorderForNumbers.classList.toggle('hide-element');
368. inputLeftBorderForNumbers.classList.toggle('hide-element');
369. labelNumbersRange.classList.toggle('hide-element');
370. labelForFilterSizeBarChart.classList.toggle('hide-element');
371. inputFilterSizeForBarChart.classList.toggle('hide-element');
372. labelNumberOfHashFunctionsForBarChart.classList.toggle('hide-element');
373. inputNumberOfHashForBarChart.classList.toggle('hide-element');
374. labelNumberOfElementsToAdd.classList.toggle('hide-element');
375. inputNumberOfElementsToAddForBarChart.classList.toggle('hide-element');
376. labelNumberOfElementsToCheck.classList.toggle('hide-element');
377. inputNumberOfElementsToCheckForBarChart.classList.toggle('hide-element');
378. generateBloomFilterForBarChartButton.classList.toggle('hide-element');
379. labelExplainingBarChart.classList.toggle('hide-element');
380. if (document.getElementById('barChart').style.display == "none") {
381. document.getElementById('barChart').style.display = "block";
382. } else {
383. document.getElementById('barChart').style.display = "none";
384. }
385. }
386. }
387. /\*\*
388. \* Generating Bloom Filter.
389. \* Adding elements to it, checking avaliability.
390. \* @param {number} filterSize
391. \* @param {number} numberOfFunctions
392. \* @param {number} numberOfElementsToAdd
393. \* @param {number} numberOfElementsToCheck
394. \*/
395. function getresultsFromBloomFilterForBarChart(filterSizeBarChart, numberOfFunctions, numberOfElementsToAdd, numberOfElementsToCheck) {
396. let hashFunctions = (new UniversalHashFunctions(numberOfFunctions)).generateFunctions();
397. let minRangeForNumber = document.getElementById('input-left-border-number-for-bar-chart').value;
398. let maxRangeForNumber = document.getElementById('input-right-border-number-for-bar-chart').value;
399. let addedElements = [];
400. let filter = [];
401. for (let index = 0; index < filterSizeBarChart; index++) {
402. filter[index] = 0;
403. }
404. for (let indexNewElement = 0; indexNewElement < numberOfElementsToAdd; ++indexNewElement) {
405. let newElement = Math.floor(Math.random() \* (maxRangeForNumber - minRangeForNumber) + minRangeForNumber);
406. if (!addedElements.includes(newElement)) {
407. addedElements.push(newElement);
408. }
409. for (let indexHashFunction = 0; indexHashFunction < hashFunctions.length; ++indexHashFunction) {
410. let currentFunction = hashFunctions[indexHashFunction];
411. let indexForFilter = currentFunction(newElement)[0] % filterSizeBarChart;
412. filter[indexForFilter] = 1;
413. }
414. }
415. let countFalsePositive = 0, countNegative = 0, countPositive = 0;
416. let definatelyNotInFilter = false;
417. for (let indexCheckelement = 0; indexCheckelement < numberOfElementsToCheck; indexCheckelement++) {
418. let newElement = Math.floor(Math.random() \* (maxRangeForNumber - minRangeForNumber) + minRangeForNumber);
419. definatelyNotInFilter = false;
420. for (let indexHashFunction = 0; indexHashFunction < hashFunctions.length; ++indexHashFunction) {
421. let currentFunction = hashFunctions[indexHashFunction];
422. let indexForFilter = currentFunction(newElement)[0] % filterSizeBarChart;
423. if (filter[indexForFilter] == 0) {
424. definatelyNotInFilter = true;
425. ++countNegative;
426. break;
427. }
428. }
429. if (!definatelyNotInFilter) {
430. if (addedElements.includes(newElement)) {
431. ++countPositive;
432. } else {
433. ++countFalsePositive;
434. }
435. }
436. }
437. return [countFalsePositive, countNegative, countPositive];
438. }
439. /\*\*
440. \* Creating bar chart for showing results of generation.
441. \*/
442. function createBarChart(numberOfFalsePositive, numberOfNegative, numberOfPositive) {
443. let canvas = document.createElement('canvas');
444. canvas.style.position = "absolute";
445. canvas.id = "barChart";
446. canvas.style.display = "none";
447. document.getElementById('zone-for-bar-chart').appendChild(canvas);
448. canvas.parentNode.style.bottom = '10px';
449. canvas.parentNode.style.width = '380px';
450. canvas.parentNode.style.top = '10px';
451. canvas.style.right = '10px';
452. canvas.style.bottom = '10px';
453. const data = {
454. labels: ['false positive', 'negative', 'positive'],
455. datasets: [{
456. label: "results",
457. data: [numberOfFalsePositive, numberOfNegative, numberOfPositive],
458. backgroundColor: [
459. 'rgba(255, 99, 132, 0.2)',
460. 'rgba(54, 162, 235, 0.2)',
461. 'rgba(255, 206, 86, 0.2)',
462. ],
463. borderColor: [
464. 'rgba(255, 99, 132, 1)',
465. 'rgba(54, 162, 235, 1)',
466. 'rgba(255, 206, 86, 1)',
467. ],
468. borderWidth: 1
469. }]
470. };
471. const config = {
472. type: 'bar',
473. data,
474. options: {
475. plugins: {
476. legend: {
477. display: false
478. }
479. },
480. scales: {
481. y: {
482. beginAtZero: true
483. }
484. }
485. }
486. };
487. const barChart = new Chart(
488. document.getElementById('barChart'),
489. config
490. );
491. return barChart;
492. }
493. /\*\*
494. \* Creates the elements needed to change the parameters of the function.
495. \*/
496. function createChangeFunctionParametersElements() {
497. // Shows/hides fields for changing function parameters.
498. let changeFunctionParametersButton = document.createElement('button');
499. changeFunctionParametersButton.className = 'change-function-parameters-button';
500. changeFunctionParametersButton.id = 'change-function-parameters-button';
501. changeFunctionParametersButton.innerHTML = "Change function parameters";
502. // The number of the function for which you want to change the parameters.
503. let numberOfFunctionToChangeInput = document.createElement('input');
504. numberOfFunctionToChangeInput.className = 'number-of-function-to-change-input';
505. numberOfFunctionToChangeInput.id = 'number-of-function-to-change-input';
506. numberOfFunctionToChangeInput.placeholder = "number of function";
507. numberOfFunctionToChangeInput.classList.toggle('hide-element');
508. numberOfFunctionToChangeInput.onblur = () => {
509. if (numberOfFunctionToChangeInput.value != "" && (isFloat(parseFloat(numberOfFunctionToChangeInput.value)) || !Number.isInteger(parseInt(numberOfFunctionToChangeInput.value)) ||
510. parseInt(numberOfFunctionToChangeInput.value) > numberOfHash || parseInt(numberOfFunctionToChangeInput.value) < 1) && numberOfFunctionToChangeInput.style.borderColor != "red") {
511. numberOfFunctionToChangeInput.style.borderColor = "red";
512. }
513. }
514. numberOfFunctionToChangeInput.addEventListener('click', () => {
515. if (numberOfFunctionToChangeInput.style.borderColor == "red") {
516. numberOfFunctionToChangeInput.style.borderColor = "";
517. numberOfFunctionToChangeInput.value = "";
518. }
519. });
520. // New parameter 'a' for function.
521. let parameterAToChangeInput = document.createElement('input');
522. parameterAToChangeInput.className = 'a-parameter-to-change-input';
523. parameterAToChangeInput.id = 'a-parameter-to-change-input';
524. parameterAToChangeInput.placeholder = "'a' parameter";
525. parameterAToChangeInput.classList.toggle('hide-element');
526. parameterAToChangeInput.onblur = () => {
527. if (parameterAToChangeInput.value != "" && (isFloat(parseFloat(parameterAToChangeInput.value)) || !Number.isInteger(parseInt(parameterAToChangeInput.value)) ||
528. String(parseInt(parameterAToChangeInput.value)).length > 16) && parameterAToChangeInput.style.borderColor != "red") {
529. parameterAToChangeInput.style.borderColor = "red";
530. }
531. }
532. parameterAToChangeInput.addEventListener('click', () => {
533. if (parameterAToChangeInput.style.borderColor == "red") {
534. parameterAToChangeInput.style.borderColor = "";
535. parameterAToChangeInput.value = "";
536. }
537. });
538. // New parameter 'b' for function.
539. let parameterBToChangeInput = document.createElement('input');
540. parameterBToChangeInput.className = 'b-parameter-to-change-input';
541. parameterBToChangeInput.id = 'b-parameter-to-change-input';
542. parameterBToChangeInput.placeholder = "'b' parameter";
543. parameterBToChangeInput.classList.toggle('hide-element');
544. parameterBToChangeInput.onblur = () => {
545. if (parameterBToChangeInput.value != "" && (isFloat(parseFloat(parameterBToChangeInput.value)) || !Number.isInteger(parseInt(parameterBToChangeInput.value)) ||
546. String(parseInt(parameterBToChangeInput.value)).length > 16) && parameterBToChangeInput.style.borderColor != "red") {
547. parameterBToChangeInput.style.borderColor = "red";
548. }
549. }
550. parameterBToChangeInput.addEventListener('click', () => {
551. if (parameterBToChangeInput.style.borderColor == "red") {
552. parameterBToChangeInput.style.borderColor = "";
553. parameterBToChangeInput.value = "";
554. }
555. });
556. // New parameter 'p' for function.
557. let parameterPToChangeInput = document.createElement('input');
558. parameterPToChangeInput.className = 'p-parameter-to-change-input';
559. parameterPToChangeInput.id = 'p-parameter-to-change-input';
560. parameterPToChangeInput.placeholder = "'p' parameter";
561. parameterPToChangeInput.classList.toggle('hide-element');
562. parameterPToChangeInput.onblur = () => {
563. if (parameterPToChangeInput.value != "" && (isFloat(parseFloat(parameterPToChangeInput.value)) || !Number.isInteger(parseInt(parameterPToChangeInput.value)) ||
564. String(parseInt(parameterPToChangeInput.value)).length > 16) && parameterPToChangeInput.style.borderColor != "red") {
565. parameterPToChangeInput.style.borderColor = "red";
566. }
567. }
568. parameterPToChangeInput.addEventListener('click', () => {
569. if (parameterPToChangeInput.style.borderColor == "red") {
570. parameterPToChangeInput.style.borderColor = "";
571. parameterPToChangeInput.value = "";
572. }
573. });
574. // When you click this button all parameters of function will change.
575. let acceptChangesToFunctionButton = document.createElement('button');
576. acceptChangesToFunctionButton.className = 'accespt-changes-to-function-button';
577. acceptChangesToFunctionButton.id = 'accespt-changes-to-function-button';
578. acceptChangesToFunctionButton.innerHTML = "Accept changes";
579. acceptChangesToFunctionButton.classList.toggle('hide-element');
580. // When you click this button all parameters of function will change randomly.
581. let changeParametersOfFunctionRandomly = document.createElement('button');
582. changeParametersOfFunctionRandomly.className = 'change-parameters-of-function-randomly';
583. changeParametersOfFunctionRandomly.id = 'change-parameters-of-function-randomly';
584. changeParametersOfFunctionRandomly.innerHTML = "Change randomly";
585. changeParametersOfFunctionRandomly.classList.toggle('hide-element');
586. changeFunctionParametersButton.onclick = () => {
587. numberOfFunctionToChangeInput.classList.toggle('hide-element');
588. parameterAToChangeInput.classList.toggle('hide-element');
589. parameterBToChangeInput.classList.toggle('hide-element');
590. parameterPToChangeInput.classList.toggle('hide-element');
591. acceptChangesToFunctionButton.classList.toggle('hide-element');
592. changeParametersOfFunctionRandomly.classList.toggle('hide-element');
593. }
594. document.getElementById('playground-main').appendChild(changeFunctionParametersButton);
595. document.getElementById('playground-main').appendChild(numberOfFunctionToChangeInput);
596. document.getElementById('playground-main').appendChild(parameterAToChangeInput);
597. document.getElementById('playground-main').appendChild(parameterBToChangeInput);
598. document.getElementById('playground-main').appendChild(parameterPToChangeInput);
599. document.getElementById('playground-main').appendChild(acceptChangesToFunctionButton);
600. document.getElementById('playground-main').appendChild(changeParametersOfFunctionRandomly);
601. }
602. /\*\*
603. \* Creating a button to show items added to a filter
604. \*/
605. function createShowAddedElementsButton() {
606. let showAddedElementsButton = document.createElement('button');
607. showAddedElementsButton.className = 'show-added-elements-button';
608. showAddedElementsButton.id = 'show-added-elements-button';
609. showAddedElementsButton.innerHTML = "Added elements";
610. let textAreaWithListOfAddedElements = document.createElement('textarea');
611. textAreaWithListOfAddedElements.className = 'text-area-with-list-of-added-elements';
612. textAreaWithListOfAddedElements.id = 'text-area-with-list-of-added-elements';
613. textAreaWithListOfAddedElements.classList.add('hide-element');
614. showAddedElementsButton.onclick = () => textAreaWithListOfAddedElements.classList.toggle('hide-element');
615. document.getElementById('playground-main').appendChild(showAddedElementsButton);
616. document.getElementById('playground-main').appendChild(textAreaWithListOfAddedElements);
617. }
618. function changeTextInPseudocodeAfterCheckingElementAvailability() {
619. document.getElementById('pseudocode-window').innerHTML =
620. "<span class='type-pseudocode'>for</span> <span class='bracket-pseudocode'>(</span><span class='type-pseudocode'>int</span> <span class='variable-pseudocode'>index</span> <span class='bracket-pseudocode'>=</span> <span class='numbers-pseudocode'>0</span><span class='bracket-pseudocode'>;</span> <span class='variable-pseudocode'>index</span> <span class='type-pseudocode'><</span> <span class='variable-pseudocode'>numberOfFunctions</span><span class='bracket-pseudocode'>;</span> <span class='bracket-pseudocode'>++</span><span class='variable-pseudocode'>index</span><span class='bracket-pseudocode'>)</span> <span class='bracket-pseudocode'>{</span><br>" +
621. "<span class='pseudocode-check-element-get-filter-index' id='pseudocode-check-element-get-filter-index'><span class='underscore-pseudocode' id='underscore-pseudocode'>---></span><span class='type-pseudocode'>int</span> <span class='variable-pseudocode'>indexInFilter</span> <span class='bracket-pseudocode'>=</span> <span class='variable-pseudocode'>listOfFunctions</span><span class='bracket-pseudocode'>[</span><span class='variable-pseudocode'>index</span><span class='bracket-pseudocode'>]</span><span class='bracket-pseudocode'>(</span><span class='variable-pseudocode'>element</span><span class='bracket-pseudocode'>)</span><span class='bracket-pseudocode'>;</span></span><br>" +
622. "<span class='pseudocode-check-element-check-cell-is-zero' id='pseudocode-check-element-check-cell-is-zero'><span class='underscore-pseudocode' id='underscore-pseudocode'>---></span><span class='type-pseudocode'>if</span> <span class='bracket-pseudocode'>(</span><span class='variable-pseudocode'>filter</span><span class='bracket-pseudocode'>[</span><span class='variable-pseudocode'>indexInFilter</span><span class='bracket-pseudocode'>]</span> <span class='bracket-pseudocode'>==</span> <span class='numbers-pseudocode'>0</span><span class='bracket-pseudocode'>)</span> <span class='bracket-pseudocode'>{</span></span><br>" +
623. "<span class='pseudocode-check-element-cell-is-zero' id='pseudocode-check-element-cell-is-zero'><span class='underscore-pseudocode' id='underscore-pseudocode'>-------></span><span class='variable-pseudocode'>gotZero</span> <span class='bracket-pseudocode'>=</span> <span class='type-pseudocode'>true</span><span class='bracket-pseudocode'>;</span> <span class='bracket-pseudocode'>}</span></span><br>" +
624. "<span class='pseudocode-check-element-check-gotZero-is-true' id='pseudocode-check-element-check-gotZero-is-true'><span class='type-pseudocode'>if</span> <span class='bracket-pseudocode'>(</span><span class='variable-pseudocode'>gotZero</span> <span class='bracket-pseudocode'>==</span> <span class='type-pseudocode'>true</span><span class='bracket-pseudocode'>)</span></span> <span class='pseudocode-check-element-print-not-in-filter' id='pseudocode-check-element-print-not-in-filter'><span class='numbers-pseudocode'>print</span><span class='bracket-pseudocode'>(</span><span class='pseudocode-check-element-string-element'>‘definitely not in filter’</span><span class='bracket-pseudocode'>);</span></span><br>" +
625. "<span class='type-pseudocode'>else</span> <span class='bracket-pseudocode'>{</span><br>" +
626. "<span id='pseudocode-check-element-check-if-list-includes-element'><span class='underscore-pseudocode' id='underscore-pseudocode'>---></span><span class='type-pseudocode'>if</span> <span class='bracket-pseudocode'>(!</span><span class='variable-pseudocode'>listOfAddedElements</span><span class='bracket-pseudocode'>.</span><span class='numbers-pseudocode'>includes</span><span class='bracket-pseudocode'>(</span><span class='variable-pseudocode'>element</span><span class='bracket-pseudocode'>))</span></span><br>" +
627. "<span id='pseudocode-check-element-print-false'><span class='underscore-pseudocode' id='underscore-pseudocode'>-------></span><span class='numbers-pseudocode'>print</span>(<span class='pseudocode-check-element-string-element'>'false positive result'</span><span class='bracket-pseudocode'>);</span></span><br>" +
628. "<span id='pseudocode-check-element-print-cant-say'><span class='underscore-pseudocode' id='underscore-pseudocode'>---></span><span class='type-pseudocode'>else</span> <span class='numbers-pseudocode'>print</span><span class='bracket-pseudocode'>(</span><span class='pseudocode-check-element-string-element'>‘can’t say for sure’</span><span class='bracket-pseudocode'>); }</span></span>";
629. }
630. /\*\*
631. \* Сheck if there is an element in the filter.
632. \* @param {Array} hashFunctions list of hash functions
633. \* @param {number} filterSize number of cells in filter
634. \* @param {Array} addedElementsList list of elements that were added to filter
635. \*/
636. function checkElementAvailability(hashFunctions, addedElementsList) {
637. visualizationInProcess = true;
638. let speedVisualization = document.getElementById('input-range-speed').value;
639. changeTextInPseudocodeAfterCheckingElementAvailability();
640. ctx = document.getElementById("canvasArrows").getContext("2d");
641. let inputAddElement = document.getElementById('add-element-input');
642. let value = parseInt(inputAddElement.value);
643. inputAddElement.value = '';
644. let filterCells = document.getElementById('filter-array-div').childNodes;
645. // True if all result values were in filter.
646. let wasInFilter = true;
647. let indexForFunctionDivs = 0;
648. let timerIdGlobalInterval = setInterval(() => {
649. if (indexForFunctionDivs == hashFunctions.length) {
650. document.getElementById('pseudocode-check-element-check-gotZero-is-true').classList.add('highlighted-pseudocode');
651. if (wasInFilter) {
652. document.getElementById('pseudocode-check-element-check-if-list-includes-element').classList.add('highlighted-pseudocode');
653. // If the element was never added but the result is positive.
654. if (!addedElementsList.includes(value)) {
655. document.getElementById('pseudocode-check-element-print-false').classList.add('highlighted-pseudocode');
656. document.getElementById('checking-element-result').innerHTML = "<b>False positive</b> result";
657. } else {
658. document.getElementById('pseudocode-check-element-print-cant-say').classList.add('highlighted-pseudocode');
659. document.getElementById('checking-element-result').innerHTML = "Can't say for sure";
660. }
661. } else {
662. document.getElementById('pseudocode-check-element-print-not-in-filter').classList.add('highlighted-pseudocode');
663. document.getElementById('checking-element-result').innerHTML = "Definitely <b>not</b> in the filter";
664. }
665. setTimeout(() => {
666. document.getElementById('checking-element-result').innerHTML = "";
667. document.getElementById('pseudocode-check-element-check-gotZero-is-true').classList.remove('highlighted-pseudocode');
668. document.getElementById('pseudocode-check-element-print-not-in-filter').classList.remove('highlighted-pseudocode');
669. document.getElementById('pseudocode-check-element-check-if-list-includes-element').classList.remove('highlighted-pseudocode');
670. document.getElementById('pseudocode-check-element-print-false').classList.remove('highlighted-pseudocode');
671. document.getElementById('pseudocode-check-element-print-cant-say').classList.remove('highlighted-pseudocode');
672. }, 2000);
673. setTimeout(() => {
674. visualizationInProcess = false;
675. }, speedVisualization / 2);
676. clearInterval(timerIdGlobalInterval);
677. }
678. let func = hashFunctions[indexForFunctionDivs];
679. let filterIndex = func(value)[0] % filterSize;
680. if (filterIndex < 0) {
681. filterIndex \*= -1;
682. filterIndex = filterSize - filterIndex;
683. }
684. // Coordinates for the value input field.
685. let rectangleInputCoordinates = inputAddElement.getBoundingClientRect();
686. let fromInputStartX = rectangleInputCoordinates.left + inputAddElement.clientWidth + 10;
687. let fromInputStartY = rectangleInputCoordinates.top + inputAddElement.height / 2;
688. let currentHashFunctionDiv = document.getElementById('hash-functions-list-div').childNodes[indexForFunctionDivs];
689. // Coordinates for the div that the arrow goes to.
690. let rectangleFunctionDivCoordinates = currentHashFunctionDiv.getBoundingClientRect();
691. let fromInputEndX = rectangleFunctionDivCoordinates.left - 20;
692. let fromInputEndY = rectangleFunctionDivCoordinates.top - 5 + currentHashFunctionDiv.clientHeight / 2;
693. ctx.beginPath();
694. drawAnArrow(ctx, fromInputStartX, fromInputStartY, fromInputEndX, fromInputEndY);
695. ctx.stroke();
696. let innerTextOfFunctionDiv = currentHashFunctionDiv.firstChild.innerHTML;
697. currentHashFunctionDiv.firstChild.innerHTML = `${filterIndex}`;
698. currentHashFunctionDiv.classList.add('highlighted');
699. document.getElementById('pseudocode-check-element-get-filter-index').classList.add('highlighted-pseudocode');
700. let indexForFilterCells = 0;
701. // Run on each function in array of has functions.
702. for (let cell of filterCells) {
703. if (indexForFilterCells == filterIndex) {
704. let fromFunctionDivStartX = rectangleFunctionDivCoordinates.left + currentHashFunctionDiv.clientWidth + 5;
705. let fromFunctionDivStartY = rectangleFunctionDivCoordinates.top + currentHashFunctionDiv.clientHeight / 2;
706. let rectangleFilterCellCoordinates = cell.getBoundingClientRect();
707. let fromFunctionDivEndX = rectangleFilterCellCoordinates.left - 20;
708. let fromFunctionDivEndY = rectangleFilterCellCoordinates.top - 5 + cell.clientHeight / 2;
709. setTimeout(() => {
710. ctx.beginPath();
711. drawAnArrow(ctx, fromFunctionDivStartX, fromFunctionDivStartY, fromFunctionDivEndX, fromFunctionDivEndY);
712. ctx.stroke();
713. currentHashFunctionDiv.firstChild.innerHTML = innerTextOfFunctionDiv;
714. currentHashFunctionDiv.classList.remove('highlighted');
715. document.getElementById('pseudocode-check-element-get-filter-index').classList.remove('highlighted-pseudocode');
716. document.getElementById('pseudocode-check-element-check-cell-is-zero').classList.add('highlighted-pseudocode');
717. if (cell.firstChild.innerHTML == '0') {
718. cell.classList.add('red-background');
719. document.getElementById('pseudocode-check-element-cell-is-zero').classList.add('highlighted-pseudocode');
720. setTimeout(() => {
721. cell.classList.remove('red-background');
722. ctx.clearRect(0, 0, 1650, 942);
723. document.getElementById('pseudocode-check-element-cell-is-zero').classList.remove('highlighted-pseudocode');
724. document.getElementById('pseudocode-check-element-check-cell-is-zero').classList.remove('highlighted-pseudocode');
725. }, speedVisualization / 3);
726. wasInFilter = false;
727. } else {
728. cell.classList.add('green-background');
729. setTimeout(() => {
730. cell.classList.remove('green-background');
731. ctx.clearRect(0, 0, 1650, 942);
732. document.getElementById('pseudocode-check-element-check-cell-is-zero').classList.remove('highlighted-pseudocode');
733. }, speedVisualization / 3);
734. }
735. }, speedVisualization / 2);
736. break;
737. }
738. ++indexForFilterCells;
739. }
740. ++indexForFunctionDivs;
741. }, speedVisualization);
742. }
743. /\*\*
744. \* Creat button that checks if element is in filter.
745. \*/
746. function createButtonCheckElementAvailability() {
747. let buttonCheckAvailability = document.createElement('button');
748. buttonCheckAvailability.className = 'check-element-availability-button';
749. buttonCheckAvailability.id = 'check-element-availability-button';
750. buttonCheckAvailability.innerHTML = 'Check availability';
751. document.getElementById('playground-main').appendChild(buttonCheckAvailability);
752. let resultOfChecking = document.createElement('span');
753. resultOfChecking.className = 'checking-element-result';
754. resultOfChecking.id = 'checking-element-result';
755. document.getElementById('playground-main').appendChild(resultOfChecking);
756. }
757. function changeTextInPseudocodeAfterAddingElement() {
758. document.getElementById('pseudocode-window').innerHTML =
759. "<span class='type-pseudocode'>int</span> <span class='variable-pseudocode'>element</span> <span class='type-pseudocode'>=</span> <span class='numbers-pseudocode'>read</span><span class='bracket-pseudocode'>()</span><span class='bracket-pseudocode'>;</span><br><span class='type-pseudocode'>for</span> <span class='bracket-pseudocode'>(</span><span class='type-pseudocode'>int</span> <span class='variable-pseudocode'>index</span> <span class='type-pseudocode'>=</span> <span class='numbers-pseudocode'>0</span><span class='bracket-pseudocode'>;</span> <span class='variable-pseudocode'>index</span> <span class='type-pseudocode'><</span> <span class='variable-pseudocode'>numberOfFunctions</span><span class='bracket-pseudocode'>;</span> <span class='bracket-pseudocode'>++</span><span class='variable-pseudocode'>index</span><span class='bracket-pseudocode'>)</span> <span class='bracket-pseudocode'>{</span><br>" +
760. "<span class='pseudocode-add-element-get-index' id='pseudocode-add-element-get-index'><span class='underscore-pseudocode' id='underscore-pseudocode'>---></span><span class='type-pseudocode'>int</span> <span class='variable-pseudocode'>indexInFilter</span> <span class='type-pseudocode'>=</span> <span class='variable-pseudocode'>listOfFunctions</span><span class='bracket-pseudocode'>[</span><span class='variable-pseudocode'>index</span><span class='bracket-pseudocode'>]</span><span class='bracket-pseudocode'>(</span><span class='variable-pseudocode'>element</span><span class='bracket-pseudocode'>)</span><span class='bracket-pseudocode'>;</span></span>" +
761. "<br><span class='pseudocode-add-element-assign-filter' id='pseudocode-add-element-assign-filter'><span class='underscore-pseudocode' id='underscore-pseudocode'>---></span><span class='variable-pseudocode'>filter</span><span class='bracket-pseudocode'>[</span><span class='variable-pseudocode'>indexInFilter</span><span class='bracket-pseudocode'>]</span> <span class='type-pseudocode'>=</span> <span class='numbers-pseudocode'>1</span><span class='bracket-pseudocode'>;</span></span><br><span class='bracket-pseudocode'>}</span>"
762. }
763. /\*\*
764. \* When adding an item, change the values in the cells.
765. \* If the element was added to the filter, change the value
766. \* of the corresponding cells by one.
767. \* @param {Array} hashFunctions list of hash functions
768. \*/
769. function changeValuesInCellsAfterAddingElement(hashFunctions) {
770. visualizationInProcess = true;
771. let speedVisualization = document.getElementById('input-range-speed').value;
772. changeTextInPseudocodeAfterAddingElement();
773. ctx = document.getElementById("canvasArrows").getContext("2d");
774. let inputAddElement = document.getElementById('add-element-input');
775. let value = parseInt(inputAddElement.value);
776. inputAddElement.value = '';
777. let filterCells = document.getElementById('filter-array-div').childNodes;
778. let indexForFunctionDivs = 0;
779. let timerId = setInterval(() => {
780. let func = hashFunctions[indexForFunctionDivs];
781. let filterIndex = func(value)[0] % filterSize;
782. if (filterIndex < 0) {
783. filterIndex \*= -1;
784. filterIndex = filterSize - filterIndex;
785. }
786. // Coordinates for the value input field.
787. let rectangleInputCoordinates = inputAddElement.getBoundingClientRect();
788. let fromInputStartX = rectangleInputCoordinates.left + inputAddElement.clientWidth + 10;
789. let fromInputStartY = rectangleInputCoordinates.top + inputAddElement.height / 2;
790. let currentHashFunctionDiv = document.getElementById('hash-functions-list-div').childNodes[indexForFunctionDivs];
791. // Coordinates for the div that the arrow goes to.
792. let rectangleFunctionDivCoordinates = currentHashFunctionDiv.getBoundingClientRect();
793. let fromInputEndX = rectangleFunctionDivCoordinates.left - 20;
794. let fromInputEndY = rectangleFunctionDivCoordinates.top - 5 + currentHashFunctionDiv.clientHeight / 2;
795. ctx.beginPath();
796. drawAnArrow(ctx, fromInputStartX, fromInputStartY, fromInputEndX, fromInputEndY);
797. ctx.stroke();
798. let innerTextOfFunctionDiv = currentHashFunctionDiv.firstChild.innerHTML;
799. currentHashFunctionDiv.firstChild.innerHTML = `${filterIndex}`;
800. currentHashFunctionDiv.classList.add('highlighted');
801. // When finding index in filter highlight the code.
802. document.getElementById('pseudocode-add-element-get-index').classList.add('highlighted-pseudocode');
803. let indexForCell = 0;
804. // Run on each cell in filter.
805. for (let cell of filterCells) {
806. // Change cell value to '1' in cell, which index is 'filterIndex'.
807. if (indexForCell == filterIndex) {
808. let fromFunctionDivStartX = rectangleFunctionDivCoordinates.left + currentHashFunctionDiv.clientWidth + 5;
809. let fromFunctionDivStartY = rectangleFunctionDivCoordinates.top + currentHashFunctionDiv.clientHeight / 2;
810. let rectangleFilterCellCoordinates = cell.getBoundingClientRect();
811. let fromFunctionDivEndX = rectangleFilterCellCoordinates.left - 20;
812. let fromFunctionDivEndY = rectangleFilterCellCoordinates.top - 5 + cell.clientHeight / 2;
813. setTimeout(() => {
814. ctx.beginPath();
815. drawAnArrow(ctx, fromFunctionDivStartX, fromFunctionDivStartY, fromFunctionDivEndX, fromFunctionDivEndY);
816. ctx.stroke();
817. currentHashFunctionDiv.firstChild.innerHTML = innerTextOfFunctionDiv;
818. currentHashFunctionDiv.classList.remove('highlighted');
819. document.getElementById('pseudocode-add-element-get-index').classList.remove('highlighted-pseudocode');
820. document.getElementById('pseudocode-add-element-assign-filter').classList.add('highlighted-pseudocode');
821. cell.firstChild.innerHTML = '1';
822. cell.classList.add('highlighted');
823. setTimeout(() => {
824. ctx.clearRect(0, 0, 1650, 942);
825. document.getElementById('pseudocode-add-element-assign-filter').classList.remove('highlighted-pseudocode');
826. }, speedVisualization / 3);
827. }, speedVisualization / 2);
828. break;
829. }
830. ++indexForCell;
831. }
832. ++indexForFunctionDivs;
833. if (indexForFunctionDivs == hashFunctions.length) {
834. setTimeout(() => {
835. visualizationInProcess = false;
836. }, speedVisualization / 2);
837. clearInterval(timerId);
838. }
839. }, speedVisualization);
840. }
841. /\*\*
842. \* Adding a field to the playground for entering an element
843. \* that will be added to the filter.
844. \*/
845. function createInputAddElement() {
846. let inputAddElement = document.createElement('input');
847. inputAddElement.className = 'add-element-input';
848. inputAddElement.id = 'add-element-input';
849. inputAddElement.placeholder = 'your number';
850. inputAddElement.onblur = () => {
851. if (inputAddElement.value != "" && (isFloat(parseFloat(inputAddElement.value)) || !Number.isInteger(parseInt(inputAddElement.value)) ||
852. String(parseInt(inputAddElement.value)).length > 16) && inputAddElement.style.borderColor != "red") {
853. inputAddElement.style.borderColor = "red";
854. }
855. }
856. inputAddElement.addEventListener('click', () => {
857. if (inputAddElement.style.borderColor == "red") {
858. inputAddElement.style.borderColor = "";
859. inputAddElement.value = "";
860. }
861. });
862. document.getElementById('playground-main').appendChild(inputAddElement);
863. }
864. /\*\*
865. \* Adding a button to the playground, after clicking on
866. \* which the element will be added to the filter.
867. \*/
868. function createButtonAddElement() {
869. let buttonAddElement = document.createElement('button');
870. buttonAddElement.className = 'add-element-button';
871. buttonAddElement.id = 'add-element-button';
872. buttonAddElement.innerHTML = 'Add element';
873. document.getElementById('playground-main').appendChild(buttonAddElement);
874. }
875. /\*\*
876. \* Creating a wrapper that will store a list of divs,
877. \* each of which is associated with a specific hash function.
878. \*/
879. function createHashFunctions() {
880. let hashFunctionsList = document.createElement('div');
881. hashFunctionsList.classList.add('hash-functions-list-div');
882. hashFunctionsList.id = 'hash-functions-list-div';
883. document.getElementById('playground-main').appendChild(hashFunctionsList);
884. }
885. /\*\*
886. \* Creating a wrapper that will store a list of divs,
887. \* each of which is associated with a specific bloom filter cell.
888. \*/
889. function createFilterArray() {
890. let filterArrayDiv = document.createElement('div');
891. filterArrayDiv.classList.add('filter-array-div');
892. filterArrayDiv.id = 'filter-array-div';
893. document.getElementById('playground-main').appendChild(filterArrayDiv);
894. }
895. /\*\*
896. \* Draws divs that match bloom filter cells.
897. \*/
898. function buildBloomFilter() {
899. // Div that contains cells for Bloom filter
900. let filterArrayDiv = document.getElementById('filter-array-div');
901. // Every new cell would be next this position.
902. let cellShift = ((filterArrayDiv.clientHeight - 50 \* filterSize) / 2);
903. for (let index = 0; index < filterSize; ++index) {
904. // Creating new cell for filter.
905. let newDivCell = document.createElement('div');
906. newDivCell.classList.add('filter-cell-div');
907. newDivCell.style.top = cellShift + 'px';
908. // Text in the cell.
909. let innerTextDivCell = document.createElement('div');
910. innerTextDivCell.className = 'filter-cell-div-inner-text';
911. innerTextDivCell.innerHTML = '0';
912. newDivCell.appendChild(innerTextDivCell);
913. // Adding cell into filter.
914. filterArrayDiv.appendChild(newDivCell);
915. cellShift += 50;
916. }
917. }
918. /\*\*
919. \* A sequence of div blocks is drawn, each of which is responsible for a hash function.
920. \* @param {number} numberOfHash amount of hash functions
921. \* @param {Array} hashFunctions array of hash functions
922. \*/
923. function buildListOfHashFunctions(numberOfHash, hashFunctions) {
924. let hashFunctionsList = document.getElementById('hash-functions-list-div');
925. hashFunctionsList.innerHTML = "";
926. // Every new hash function would be next this position.
927. let hashFunctionShift = ((hashFunctionsList.clientHeight - 50 \* numberOfHash) / 2);
928. for (let index = 0; index < numberOfHash; ++index) {
929. // Creating new hash function.
930. let newHashFunction = document.createElement('div');
931. newHashFunction.classList.add('hash-function-div');
932. newHashFunction.style.top = hashFunctionShift + 'px';
933. newHashFunction.dataToggle = "tooltip";
934. let [a, b, p] = [hashFunctions[index](1)[1], hashFunctions[index](1)[2], hashFunctions[index](1)[3]];
935. newHashFunction.title = `(${a}x + ${b} mod(${p})) mod(${filterSize})`;
936. // Text in the cell.
937. let innerTextHashFunction = document.createElement('div');
938. innerTextHashFunction.className = 'hash-function-div-inner-text';
939. innerTextHashFunction.innerHTML = 'k' + '<sub>' + (index + 1);
940. newHashFunction.appendChild(innerTextHashFunction);
941. hashFunctionsList.appendChild(newHashFunction);
942. hashFunctionShift += 50;
943. }
944. }

**1.1.2 Файл canvas.js**

function drawAnArrow(context, fromx, fromy, tox, toy) {

context.lineWidth = 2;

context.strokeStyle = 'khaki';

var headlen = 7; // length of head in pixels

var dx = tox - fromx;

var dy = toy - fromy;

var angle = Math.atan2(dy, dx);

context.moveTo(fromx, fromy);

context.lineTo(tox, toy);

context.lineTo(tox - headlen \* Math.cos(angle - Math.PI / 6), toy - headlen \* Math.sin(angle - Math.PI / 6));

context.moveTo(tox, toy);

context.lineTo(tox - headlen \* Math.cos(angle + Math.PI / 6), toy - headlen \* Math.sin(angle + Math.PI / 6));

}

**1.1.3 Файл footer.js**

/\*\*

\* Fill footer with elements.

\*/

function fillTheFooterBloomFilter() {

// Element in which some settings of footer are situated.

let elementsPlaygroundFooter = document.getElementById('elements-playground-footer');

document.getElementById('playground-footer-title').style.display = "none";

addInputRangeForSpeedVisualization(elementsPlaygroundFooter);

createLabelHintAboutHashFunctions(elementsPlaygroundFooter);

}

function createLabelHintAboutHashFunctions(elementsPlaygroundFooter) {

let labelFooterHint = document.createElement('label');

labelFooterHint.innerHTML = "When hovering over a hash function, you can see how the final value is calculated!"

labelFooterHint.style.position = "absolute";

labelFooterHint.style.left = "10px";

labelFooterHint.style.top = "100px";

labelFooterHint.style.color = "white";

elementsPlaygroundFooter.appendChild(labelFooterHint);

}

/\*\*

\* Adding the input range that can regulate speed of visualization.

\* @param {HTMLDivElement} elementsPlaygroundFooter element in which some settings of footer are situated

\*/

function addInputRangeForSpeedVisualization(elementsPlaygroundFooter) {

let shellForInputRangeSpeed = document.createElement('div');

shellForInputRangeSpeed.className = 'shell-input-range-speed';

shellForInputRangeSpeed.id = 'shell-input-range-speed';

let inputRangeSpeedVisual = document.createElement('input');

inputRangeSpeedVisual.className = 'input-range-speed';

inputRangeSpeedVisual.id = 'input-range-speed';

inputRangeSpeedVisual.type = 'range';

inputRangeSpeedVisual.min = "500";

inputRangeSpeedVisual.max = "3000";

inputRangeSpeedVisual.step = "any";

shellForInputRangeSpeed.innerHTML = '<i>Speed visualization:</i>';

let subIndeciesForSpeedRange = document.createElement('div');

subIndeciesForSpeedRange.className = 'indecies-for-speed-range';

subIndeciesForSpeedRange.id = 'indecies-for-speed-range';

subIndeciesForSpeedRange.innerHTML = "faster<span style='color:grey'>----------------</span>slower";

shellForInputRangeSpeed.appendChild(inputRangeSpeedVisual);

elementsPlaygroundFooter.appendChild(subIndeciesForSpeedRange);

elementsPlaygroundFooter.appendChild(shellForInputRangeSpeed);

}

# **1.1.4 Файл header.js**

/\*\*

\* Building an interface for the Bloom filter header.

\*/

function fillTheHeaderBloomFilter() {

// DIV containing all header elements.

let elementsPlaygroundCap = document.getElementById('elements-playground-cap');

elementsPlaygroundCap.innerHTML = "";

// Creating settings for input filter size.

let inputFilterSize = createInputFilterSize(elementsPlaygroundCap);

// Creating settings for input number of hesh.

let inputNumberOfHash = createInputNumberOfHash(elementsPlaygroundCap);

// Add button for building the filter.

let buttonBuildFilter = createButtonBuldingTheFilter(elementsPlaygroundCap);

labelRestrictionsForFilterAndFunctions(elementsPlaygroundCap);

addEventWhenButtonBuildFilterWasClicked(buttonBuildFilter, inputFilterSize, inputNumberOfHash);

}

/\*\*

\* Label that shows restriction for filter size.

\* @param {object} elementsPlaygroundCap div containing header elements

\*/

function labelRestrictionsForFilterAndFunctions(elementsPlaygroundCap) {

let divLabelRestrictionsForFilterSize = document.createElement('div');

divLabelRestrictionsForFilterSize.innerHTML = "<i>restrictions: 1 ≤ value ≤ 13</i><br><br><br><i>restrictions: 1 ≤ value ≤ 13</i>";

divLabelRestrictionsForFilterSize.style.position = "absolute";

divLabelRestrictionsForFilterSize.style.left = "300px";

divLabelRestrictionsForFilterSize.style.top = "9px";

divLabelRestrictionsForFilterSize.style.color = "rgb(48, 184, 246, 0.95)";

elementsPlaygroundCap.appendChild(divLabelRestrictionsForFilterSize);

}

/\*\*

\* Creating an element that serves as an input field

\* for the element to be added to the bloom filter.

\* @param {object} elementsPlaygroundCap div containing header elements

\* @returns field for input nwe value

\*/

function createInputFilterSize(elementsPlaygroundCap) {

let divFilterSize = document.createElement('div');

divFilterSize.innerHTML = '<i>Filter size: </i>';

divFilterSize.className = 'div-filter-size';

let inputFilterSize = document.createElement('input');

inputFilterSize.className = "input-filter-size-header";

inputFilterSize.style = "background: white";

inputFilterSize.style.border = "1.5px solid black";

inputFilterSize.placeholder = 'your number';

divFilterSize.appendChild(inputFilterSize);

elementsPlaygroundCap.appendChild(divFilterSize);

return inputFilterSize;

}

/\*\*

\* Creating an element that serves as an input field

\* for number of hash functions.

\* @param {object} elementsPlaygroundCap div containing header elements

\* @returns field for input new number of hash functions

\*/

function createInputNumberOfHash(elementsPlaygroundCap) {

let divNumberOfHesh = document.createElement('div');

divNumberOfHesh.innerHTML = '<i>Number of hash: </i>';

divNumberOfHesh.className = 'div-hesh-number';

let inputNumberOfHesh = document.createElement('input');

inputNumberOfHesh.style = "background-color: white";

inputNumberOfHesh.style.border = "1.5px solid black";

inputNumberOfHesh.placeholder = 'your number';

divNumberOfHesh.appendChild(inputNumberOfHesh);

elementsPlaygroundCap.appendChild(divNumberOfHesh);

return inputNumberOfHesh;

}

/\*\*

\* Creating an element that serves as a button

\* that builds interface for filter.

\* @param {object} elementsPlaygroundCap div containing header elements

\* @returns Button that builds filter.

\*/

function createButtonBuldingTheFilter(elementsPlaygroundCap) {

let buttonBuildFilter = document.createElement('button');

buttonBuildFilter.innerHTML = "BUILD FILTER";

buttonBuildFilter.className = 'button-build-filter';

buttonBuildFilter.id = 'button-build-filter';

elementsPlaygroundCap.appendChild(buttonBuildFilter);

return buttonBuildFilter;

}

**1.1.5 Файл js.js**

/\*\*

\* As the data structure Bloom filter was chosen.

\*/

document.getElementById("bloom-filter-carousel-element").onclick = function() {

document.getElementById('bloom-filter-description').style.display = "block";

document.getElementById("bloom-filter-carousel-element").style.border = "1px solid white";

let elementInCarouselBloomFilter = document.getElementById("bloom-filter-carousel-element");

if (elementInCarouselBloomFilter.hasAttribute('in-use')) {

return;

}

elementInCarouselBloomFilter.setAttribute('in-use', 'bloom-filter-carousel-element');

drawInterface();

}

/\*\*

\* Building an interface in the cap of playground for the user.

\*/

function drawInterface() {

switch(document.getElementById("bloom-filter-carousel-element").getAttribute('in-use')) {

case 'bloom-filter-carousel-element':

fillTheHeaderBloomFilter();

fillTheFooterBloomFilter();

break;

}

}

**1.1.6 Файл universal\_hash\_functions.js**

class UniversalHashFunctions {

constructor(numberOfFunctions) {

this.numberOfFunctions = numberOfFunctions;

}

/\*\*

\* Generates array of universal hash functions.

\* @returns Array of hash functions.

\*/

generateFunctions() {

let p = 115249;

let functions = [];

for (let index = 0; index < this.numberOfFunctions; ++index) {

let a = Math.floor(Math.random() \* (p - 1) + 1);

let b = Math.floor(Math.random() \* p);

let newFunction = value => {

return [(a \* value + b) % p, a, b, p];

}

functions[index] = newFunction;

}

return functions;

}

}

**1.2 Файлы расширения .html**

**1.2.1 Файл vads.html**

<!DOCTYPE html>

<html lang="en">

<head>

<meta charset="UTF-8">

<meta http-equiv="X-UA-Compatible" content="IE=edge">

<meta name="viewport" content="width=device-width, initial-scale=1.0">

<title>VADS</title>

<link rel="stylesheet" href="styles/main.css">

<link rel="stylesheet" href="styles/bloom.css">

<link rel="stylesheet" href="styles/footer.css">

<link rel="stylesheet" href="styles/header.css">

</head>

<body>

<canvas id="canvasArrows" width="1650" height="942"></canvas>

<div class="main-menu">

<div class="title-block" id="title-block">

VADS

</div>

<div class="elements-carousel">

<div class="bloom-filter-carousel-element" id="bloom-filter-carousel-element" data-toggle="tooltip">

<div class="bloom-filter-picture" id="bloom-filter-picture">

<img src="images/bloom.jpg" width="86px" height="88px">

</div>

<div class="bloom-filter-header-carousel" id="bloom-filter-header-carousel">

<b>BLOOM FILTER</b><br>

Probabilistic data structure

</div>

</div>

<div class="bloom-filter-description" id="bloom-filter-description" style="display: none;">

<h3>Description</h3>

The Bloom filter is a bitmap of <b>m</b> bits. At the very beginning, the user defines <b>k</b> independent hash functions, each of which is mapped to a filter, that is, to a bit array.

If the function mapped to the i-th cell, the i-th bit becomes equal to <b>one</b>.<br>

Optimal number of hash functions: (m/n)ln2 ≈ 0.6931(m/n).

<h3>Use cases</h3>

Bloom filter allows you to determine that the element is <b>not</b> included in the set.For example, if a database is accessed, then the filter can say with <b>100%</b> probability that the element is <b>not</b> there.

<h3>Output cases</h3>

There are <b>three</b> possible outputs: the element is <b>definitely not</b> in the filter, the element <b>may be</b> present, or a <b>false positive</b> (occurs when the filter says that the element may be present, but it was not added).

<h3>Probabilities</h3>

False positive probability: (1-e<sup>-kn/m</sup></sup>)<sup>k</sup><br>

False alarm probability: 2<sup>-k</sup> ≈ 0.6185<sup>m/n</sup>, where k - number of functions, m - filter size, n - number of added elements.

</div>

</div>

</div>

<div class="playground">

<div class="elements-playground-cap" id="elements-playground-cap">

<div class="playground-cap-title" id="playground-cap-title">input data</div>

</div>

<div class="playground-main" id="playground-main">

<div class="playground-main-title" id="playground-main-title">playground</div>

</div>

<div class="elements-playground-footer" id="elements-playground-footer">

<div class="playground-footer-title" id="playground-footer-title">settings</div>

<div class="pseudocode-window" id="pseudocode-window">

<div class="pseudocode-titile" id="pseudocode-titile">CODE</div>

</div>

</div>

</div>

<script src="https://cdn.jsdelivr.net/npm/chart.js"></script>

<script src="scripts/canvas.js"></script>

<script src="scripts/js.js"></script>

<script src="scripts/bloom.js"></script>

<script src="scripts/universal\_hash\_functions.js"></script>

<script src="scripts/header.js"></script>

<script src="scripts/footer.js"></script>

</body>

</html>

**1.3 Файлы расширения .css**

**1.3.1 Файл bloom.css**

.bloom-filter-carousel-element {

border: 1px solid black;

position: absolute;

left: 5px;

right: 5px;

top: 5px;

height: 100px;

background-color: rgb(129, 107, 81);

}

.bloom-filter-carousel-element:hover {

background-color: rgb(170, 165, 158);

}

.bloom-filter-carousel-element:hover {

cursor: pointer;

}

.div-filter-size {

position: absolute;

left: 10px;

top: 10px;

}

.div-hesh-number {

position: absolute;

left: 10px;

bottom: 10px;

}

.filter-array-div {

position: absolute;

left: 50%;

width: 50px;

top: 0px;

bottom: 0px;

}

.hash-functions-list-div {

position: absolute;

left: 30%;

width: 50px;

top: 0px;

bottom: 0px;

}

.filter-cell-div {

border: 1px solid black;

width: 50px;

height: 50px;

position: absolute;

text-align: center;

background-color: rgb(134, 121, 103);

}

.hash-function-div {

border: 1px solid black;

width: 50px;

height: 50px;

position: absolute;

text-align: center;

background-color: rgb(134, 121, 103);

}

.filter-cell-div-inner-text {

position: absolute;

font-size: 25px;

left: 50%;

margin-left: -5px;

top: 50%;

margin-top: -16px;

}

.hash-function-div-inner-text {

position: absolute;

font-size: 23px;

left: 50%;

margin-left: -7px;

top: 50%;

margin-top: -16px;

}

.add-element-button {

position: absolute;

left: 10px;

top: 50%;

width: 105.5px;

height: 35px;

margin-top: -52px;

background-color: rgb(117, 90, 54);

font-size: 12px;

}

.add-element-button:hover {

cursor: pointer;

}

.check-element-availability-button {

position: absolute;

left: 10px;

bottom: 50%;

width: 105.5px;

height: 35px;

margin-bottom: -46px;

background-color: rgb(117, 90, 54);

font-size: 12px;

}

.check-element-availability-button:hover {

cursor: pointer;

}

.checking-element-result {

position: absolute;

left: 10px;

bottom: 50%;

height: 30px;

margin-bottom: -90px;

color: rgb(29, 221, 29);

}

.add-element-input {

position: absolute;

left: 10px;

top: 50%;

width: 100px;

margin-top: -13px;

background-color: white;

border: 1.5px solid black;

}

.highlighted {

background-color: rgb(190, 178, 160);

}

.red-background {

background-color: red;

}

.green-background {

background-color: rgb(3, 245, 3);

}

.bloom-filter-picture {

border: 1px solid black;

position: absolute;

top: 5px;

left: 5px;

bottom: 5px;

right: 70%;

float: left;

}

.bloom-filter-header-carousel {

border: 1px solid black;

position: absolute;

top: 5px;

float: right;

right: 5px;

bottom: 5px;

left: 31%;

text-align: center;

line-height: 40px;

}

.show-added-elements-button {

position: absolute;

float: left;

left: 10px;

top: 208px;

width: 200px;

height: 30px;

font-size: 13px;

background-color: rgb(117, 90, 54);

}

.show-added-elements-button:hover {

cursor: pointer;

}

.change-function-parameters-button {

position: absolute;

float: left;

left: 10px;

bottom: 215px;

width: 200px;

height: 30px;

font-size: 13px;

background-color: rgb(117, 90, 54);

}

.change-function-parameters-button:hover {

cursor: pointer;

}

.text-area-with-list-of-added-elements {

position: absolute;

float: left;

left: 10px;

top: 10px;

width: 194px;

height: 175px;

font-size: 17px;

border: 1px solid #000;

bottom: 10px;

background-color: rgb(93, 80, 62, 0.3);

resize: none;

pointer-events: none;

}

.hide-element {

display: none;

}

.number-of-function-to-change-input {

position: absolute;

float: left;

left: 10px;

bottom: 183px;

width: 194px;

height: 20px;

font-size: 13px;

background-color: white;

border: 1.5px solid black;

}

.a-parameter-to-change-input {

position: absolute;

float: left;

left: 10px;

bottom: 150px;

width: 194px;

height: 20px;

font-size: 13px;

background-color: white;

border: 1.5px solid black;

}

.b-parameter-to-change-input {

position: absolute;

float: right;

left: 10px;

bottom: 118px;

width: 194px;

height: 20px;

font-size: 13px;

background-color: white;

border: 1.5px solid black;

}

.p-parameter-to-change-input {

position: absolute;

float: left;

left: 10px;

bottom: 85px;

width: 194px;

height: 20px;

font-size: 13px;

background-color: white;

border: 1.5px solid black;

}

.accespt-changes-to-function-button {

position: absolute;

float: left;

left: 10px;

bottom: 45px;

width: 200px;

height: 30px;

font-size: 13px;

background-color: rgb(98, 80, 57);

}

.accespt-changes-to-function-button:hover {

cursor: pointer;

}

.change-parameters-of-function-randomly {

position: absolute;

float: left;

left: 10px;

bottom: 10px;

width: 200px;

height: 30px;

font-size: 13px;

background-color: rgb(98, 80, 57);

}

.change-parameters-of-function-randomly:hover {

cursor: pointer;

}

.zone-for-bar-chart {

float: right;

position: absolute;

right: 0px;

top: 0px;

bottom: 0px;

left: 70%;

}

.show-zone-bar-chart-button {

position: absolute;

left: 0px;

top: 0px;

right: 0px;

height: 30px;

background-color: rgb(117, 90, 54);

}

.show-zone-bar-chart-button:hover {

cursor: pointer;

}

.input-filter-size-for-bar-chart {

position: absolute;

top: 53px;

width: 373px;

background-color: white;

border: 1.5px solid black;

}

.input-number-of-hash-functions-for-bar-chart {

position: absolute;

top: 98px;

width: 373px;

background-color: white;

border: 1.5px solid black;

}

.input-number-of-elements-to-add-for-bar-chart {

position: absolute;

top: 142px;

width: 373px;

background-color: white;

border: 1.5px solid black;

}

.input-number-of-elements-to-check-for-bar-chart {

position: absolute;

top: 186px;

width: 373px;

background-color: white;

border: 1.5px solid black;

}

.input-left-border-number-for-bar-chart {

position: absolute;

top: 230px;

width: 180px;

background-color: white;

border: 1.5px solid black;

}

.input-right-border-number-for-bar-chart {

position: absolute;

right: 0px;

top: 230px;

width: 180px;

background-color: white;

border: 1.5px solid black;

}

.button-to-build-filter-bar-chart {

position: absolute;

top: 260px;

height: 30px;

width: 379px;

background-color: rgb(98, 80, 57);

}

.button-to-build-filter-bar-chart:hover {

cursor: pointer;

}

.underscore-pseudocode {

color: rgb(29, 28, 28);

}

.type-pseudocode {

color: rgb(55, 107, 248);

}

.bracket-pseudocode {

color: white;

}

.variable-pseudocode {

color: rgb(0, 174, 255);

}

.numbers-pseudocode {

color: rgba(156, 156, 45, 0.972);

}

.highlighted-pseudocode {

background-color: wheat;

}

.pseudocode-check-element-string-element {

color: rgb(247, 188, 80);

}

.playground-main-title {

position: absolute;

font-size: 30px;

left: 50%;

top: 50%;

margin-top: -30px;

margin-left: -55px;

font-weight: 600;

}

.button-clear-filter {

position: absolute;

top: 50%;

right: 470px;

height: 30px;

width: 100px;

margin-top: -14px;

background-color: rgb(98, 80, 57);

}

.button-clear-filter:hover {

cursor: pointer;

}

**1.3.2 Файл footer.css**

.shell-input-range-speed {

position: absolute;

left: 5px;

top: 5px;

}

.input-range-speed {

margin: 10px;

}

.input-range-speed:hover {

cursor: pointer;

}

.pseudocode-titile {

position: absolute;

left: 50%;

top: 50%;

font-size: 30px;

margin-top: -20px;

margin-left: -35px;

color: darkgoldenrod;

}

.playground-footer-title {

position: absolute;

top: 50%;

left: 33%;

font-size: 30px;

margin-top: -15px;

font-weight: 600;

}

.indecies-for-speed-range {

position: absolute;

bottom: 140px;

left: 143px;

font-size: 13px;

}

**1.3.3 Файл header.css**

.button-build-filter {

position: absolute;

font-size: 20px;

top: 20px;

right: 10px;

bottom: 20px;

width: 200px;

background-color: rgb(13, 119, 3);

}

.button-build-filter:hover {

cursor: pointer;

}

.playground-cap-title {

position: absolute;

left: 50%;

top: 50%;

font-size: 30px;

font-weight: 600;

margin-left: -46px;

margin-top: -20px;

}

.input-filter-size-header {

position: absolute;

top: 0px;

left: 111px;

}

.button-show-description-filter {

position: absolute;

width: 200px;

height: 35px;

right: 250px;

font-size: 12px;

top: 28px;

background-color: rgb(122, 120, 120);

}

.button-show-description-filter:hover {

cursor: pointer;

}

**1.3.4 Файл main.css**

body {

background: linear-gradient(to bottom right, rgb(138, 110, 47), rgb(155, 115, 122));

}

.main-menu {

border: 1px solid black;

position: absolute;

left: 10px;

top: 10px;

bottom: 10px;

right: 80%;

float: left;

}

.playground {

border: 1px solid black;

position: absolute;

right: 10px;

top: 10px;

bottom: 10px;

left: 21%;

float: right;

}

.title-block {

border: 1px solid black;

position: absolute;

left: 0px;

right: 0px;

top: 0px;

bottom: 90%;

font-size: 50px;

text-align: center;

line-height: 90px;

background-color: rgb(134, 108, 76);

}

.elements-carousel {

border: 1px solid black;

position: absolute;

left: 0px;

right: 0px;

top: 15%;

bottom: 0px;

}

.elements-playground-cap {

border: 1px solid black;

position: absolute;

float: left;

left: 0px;

right: 0px;

top: 0px;

bottom: 90%;

}

.elements-playground-footer {

border: 1px solid black;

position: absolute;

left: 0px;

right: 0px;

top: 80%;

bottom: 0px;

}

.pseudocode-window {

border: 1px solid white;

position: absolute;

left: 70%;

right: 0px;

top: 0px;

bottom: 0px;

background-color: rgb(29, 28, 28);

padding-left: 10px;

padding-top: 10px;

color: white;

}

.playground-main {

border: 1px solid black;

position: absolute;

left: 0px;

right: 0px;

top: 10%;

bottom: 20%;

}

.bloom-filter-description {

position: absolute;

bottom: 10px;

left: 10px;

right: 10px;

top: 15%;

}

# **ПРИЛОЖЕНИЕ 1**

# **Список использованной литературы**

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2. ГОСТ 19.102-77 Стадии разработки. //Единая система программной документации. – М.: ИПК Издательство стандартов, 2001.
3. ГОСТ 19.103-77 Обозначения программ и программных документов. //Единая система программной документации. – М.: ИПК Издательство стандартов, 2001.
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9. ГОСТ 19.604-78 Правила внесения изменений в программные документы, выполненные печатным способом. //Единая система программной документации. – М.: ИПК Издательство стандартов, 2001.V
10. VisuAlgo. [Электронный ресурс]//URL: <https://visualgo.net/ru> (Дата обращения: 03.02.2022, режим доступа: свободный).
11. Vamonos. [Электронный ресурс]//URL: https://rosulek.github.io/vamonos/ (Дата обращения: 03.02.2022, режим доступа: свободный).

**ЛИСТ РЕГИСТРАЦИИ ИЗМЕНЕНИЙ**

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Лист регистрации изменений | | | | | | | | | |
| Номера листов (страниц) | | | | | Всего листов (страниц в докум.) | № документа | Входящий № сопроводительного докум. и дата | Подп. | Дата |
| Изм. | Измененных | Замененных | Новых | Аннулированных |  |  |  |  |  |
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