

```
1 C:\Users\kanis\.jdk\openjdk-16.0.2\bin\java.exe "-
  javaagent:C:\Program Files\JetBrains\IntelliJ IDEA
  2021.2.1\lib\idea_rt.jar=53130:C:\Program Files\
  JetBrains\IntelliJ IDEA 2021.2.1\bin" -Dfile.encoding
  =UTF-8 -classpath C:\Users\kanis\IdeaProjects\
  DistributedSys\Project3\Project3Task0\out\
  production\Project3Task0 blockchaintask.BlockChain
2
3 0. View basic blockchain status
4 1. Add a transaction to blockchain.
5 2. Verify the blockchain.
6 3. View the blockchain.
7 4. Corrupt the chain.
8 5. Hide the corruption by repairing the chain
9 6. Exit
10 0
11 Current size of the chain: 1
12 Difficulty of the most recent block: 2
13 Total difficulty for all blocks: 2
14 Approximate hashes per second on this machine:
  2873563
15 Expected total hashes required for the whole chain:
  256.0
16 Nonce for the most recent block: 4
17 Chain hash:
  009AFFED3499DDA88F07358C965E637B435E2C8577B38057DB0AD
  B5AC205114E
18
19 0. View basic blockchain status
20 1. Add a transaction to blockchain.
21 2. Verify the blockchain.
22 3. View the blockchain.
23 4. Corrupt the chain.
24 5. Hide the corruption by repairing the chain
25 6. Exit
26 1
27 Enter difficulty > 0
28 3
29 Enter transaction
30 Kanishka pays Bob 100 dscoin
31 Total execution time to add this block was 34
```

```
31 milliseconds
32
33 0. View basic blockchain status
34 1. Add a transaction to blockchain.
35 2. Verify the blockchain.
36 3. View the blockchain.
37 4. Corrupt the chain.
38 5. Hide the corruption by repairing the chain
39 6. Exit
40 1
41 Enter difficulty > 0
42 3
43 Enter transaction
44 Bob pays Kanishka 20 dscoin
45 Total execution time to add this block was 27
  milliseconds
46
47 0. View basic blockchain status
48 1. Add a transaction to blockchain.
49 2. Verify the blockchain.
50 3. View the blockchain.
51 4. Corrupt the chain.
52 5. Hide the corruption by repairing the chain
53 6. Exit
54 1
55 Enter difficulty > 0
56 4
57 Enter transaction
58 Kanishka pays Carol 23 dscoin
59 Total execution time to add this block was 15
  milliseconds
60
61 0. View basic blockchain status
62 1. Add a transaction to blockchain.
63 2. Verify the blockchain.
64 3. View the blockchain.
65 4. Corrupt the chain.
66 5. Hide the corruption by repairing the chain
67 6. Exit
68 1
69 Enter difficulty > 0
```

```

70 5
71 Enter transaction
72 Donna pays Kanishka 34 dscoin
73 Total execution time to add this block was 1772
  milliseconds
74
75 0. View basic blockchain status
76 1. Add a transaction to blockchain.
77 2. Verify the blockchain.
78 3. View the blockchain.
79 4. Corrupt the chain.
80 5. Hide the corruption by repairing the chain
81 6. Exit
82 3
83 View the blockchain
84 {"ds_chain{" : [ {"index" : "0","time stamp" : "2021
  -10-23 15:54:25.55", "Tx" : "Genesis", "PrevHash
  " : "", "nonce" : "4", "difficulty" : "2"}
85 {"index" : "1","time stamp" : "2021-10-23 15:54:41.
  006", "Tx" : "Kanishka pays Bob 100 dscoin", "
  PrevHash" : "
  009AFFED3499DDA88F07358C965E637B435E2C8577B38057DB0A
  DB5AC205114E", "nonce" : "4003", "difficulty" : "3"}
86 {"index" : "2","time stamp" : "2021-10-23 15:54:54.
  298", "Tx" : "Bob pays Kanishka 20 dscoin", "
  PrevHash" : "
  0004FB16C09171CE87065D657677197BC5BCC7A6EC7284670530
  0851717884E1", "nonce" : "9103", "difficulty" : "3"}
87 {"index" : "3","time stamp" : "2021-10-23 15:55:06.
  672", "Tx" : "Kanishka pays Carol 23 dscoin", "
  PrevHash" : "
  000F45B806DD6B1345DB1E6EED5B004A4B965D089474969FF404
  F8DA4BFAE946", "nonce" : "25539", "difficulty" : "4
  "}
88 {"index" : "4","time stamp" : "2021-10-23 15:55:20.
  222", "Tx" : "Donna pays Kanishka 34 dscoin", "
  PrevHash" : "
  00009985EA97F29F52D3AEC52BD18E1F9D77FB749CA6A688B5B4
  CDDD2D4CE87B", "nonce" : "1286077", "difficulty" : "
  5"}
89 ],"chainHash": "

```

```

89      000009F7AC3789F4297A5DDCEFB3AA629770EF6689AF55BE65A7
      B786EC90567D"}
90
91 0. View basic blockchain status
92 1. Add a transaction to blockchain.
93 2. Verify the blockchain.
94 3. View the blockchain.
95 4. Corrupt the chain.
96 5. Hide the corruption by repairing the chain
97 6. Exit
98 1
99 Enter difficulty > 0
100 2
101 Enter transaction
102 Carol pays Donna 1 dscoin
103 Total execution time to add this block was 0
    milliseconds
104
105 0. View basic blockchain status
106 1. Add a transaction to blockchain.
107 2. Verify the blockchain.
108 3. View the blockchain.
109 4. Corrupt the chain.
110 5. Hide the corruption by repairing the chain
111 6. Exit
112 3
113 View the blockchain
114 {"ds_chain{" : [ {"index" : "0","time stamp" : "2021
    -10-23 15:54:25.55", "Tx" : "Genesis", "PrevHash
    " : "", "nonce" : "4", "difficulty" : "2"}
115 {"index" : "1","time stamp" : "2021-10-23 15:54:41.
    006", "Tx" : "Kanishka pays Bob 100 dscoin", "
    PrevHash" : "
    009AFFED3499DDA88F07358C965E637B435E2C8577B38057DB0A
    DB5AC205114E", "nonce" : "4003", "difficulty" : "3"}
116 {"index" : "2","time stamp" : "2021-10-23 15:54:54.
    298", "Tx" : "Bob pays Kanishka 20 dscoin", "
    PrevHash" : "
    0004FB16C09171CE87065D657677197BC5BCC7A6EC7284670530
    0851717884E1", "nonce" : "9103", "difficulty" : "3"}

```

```

117 {"index" : "3","time stamp" : "2021-10-23 15:55:06.
    672", "Tx" : "Kanishka pays Carol 23 dscoin", "
    PrevHash" : "
    000F45B806DD6B1345DB1E6EED5B004A4B965D089474969FF404
    F8DA4BFAE946", "nonce" : "25539", "difficulty" : "4
    "}
118 {"index" : "4","time stamp" : "2021-10-23 15:55:20.
    222", "Tx" : "Donna pays Kanishka 34 dscoin", "
    PrevHash" : "
    00009985EA97F29F52D3AEC52BD18E1F9D77FB749CA6A688B5B4
    CDDD2D4CE87B", "nonce" : "1286077", "difficulty" : "
    5"}
119 {"index" : "5","time stamp" : "2021-10-23 15:55:35.
    833", "Tx" : "Carol pays Donna 1 dscoin", "PrevHash
    " : "
    000009F7AC3789F4297A5DDCEFB3AA629770EF6689AF55BE65A7
    B786EC90567D", "nonce" : "247", "difficulty" : "2"}
120 ],"chainHash": "
    00CF2F32C34BF4B719FCA29291ABBD9F0C85A00187C95DB335AA
    2F365E093492"}
121
122 0. View basic blockchain status
123 1. Add a transaction to blockchain.
124 2. Verify the blockchain.
125 3. View the blockchain.
126 4. Corrupt the chain.
127 5. Hide the corruption by repairing the chain
128 6. Exit
129 4
130 Corrupt the Blockchain
131 Enter the block ID of block to corrupt
132 0
133 Enter new data for block 0
134 Carol pays Kanishka 1000 dscoin
135 Block 0 now holds Carol pays Kanishka 1000 dscoin
136
137 0. View basic blockchain status
138 1. Add a transaction to blockchain.
139 2. Verify the blockchain.
140 3. View the blockchain.
141 4. Corrupt the chain.

```

```

142 5. Hide the corruption by repairing the chain
143 6. Exit
144 3
145 View the blockchain
146 {"ds_chain{" : [ {"index" : "0","time stamp" : "2021
    -10-23 15:54:25.55", "Tx" : "Carol pays Kanishka
    1000 dscoin", "PrevHash" : "", "nonce" : "4", "
    difficulty" : "2"}
147 {"index" : "1","time stamp" : "2021-10-23 15:54:41.
    006", "Tx" : "Kanishka pays Bob 100 dscoin", "
    PrevHash" : "
    009AFFED3499DDA88F07358C965E637B435E2C8577B38057DB0A
    DB5AC205114E", "nonce" : "4003", "difficulty" : "3"}
148 {"index" : "2","time stamp" : "2021-10-23 15:54:54.
    298", "Tx" : "Bob pays Kanishka 20 dscoin", "
    PrevHash" : "
    0004FB16C09171CE87065D657677197BC5BCC7A6EC7284670530
    0851717884E1", "nonce" : "9103", "difficulty" : "3"}
149 {"index" : "3","time stamp" : "2021-10-23 15:55:06.
    672", "Tx" : "Kanishka pays Carol 23 dscoin", "
    PrevHash" : "
    000F45B806DD6B1345DB1E6EED5B004A4B965D089474969FF404
    F8DA4BFAE946", "nonce" : "25539", "difficulty" : "4
    "}
150 {"index" : "4","time stamp" : "2021-10-23 15:55:20.
    222", "Tx" : "Donna pays Kanishka 34 dscoin", "
    PrevHash" : "
    00009985EA97F29F52D3AEC52BD18E1F9D77FB749CA6A688B5B4
    CDDD2D4CE87B", "nonce" : "1286077", "difficulty" : "
    5"}
151 {"index" : "5","time stamp" : "2021-10-23 15:55:35.
    833", "Tx" : "Carol pays Donna 1 dscoin", "PrevHash
    " : "
    000009F7AC3789F4297A5DDCEFB3AA629770EF6689AF55BE65A7
    B786EC90567D", "nonce" : "247", "difficulty" : "2"}
152 ],"chainHash": "
    00CF2F32C34BF4B719FCA29291ABBD9F0C85A00187C95DB335AA
    2F365E093492"}
153
154 0. View basic blockchain status
155 1. Add a transaction to blockchain.

```

```

156 2. Verify the blockchain.
157 3. View the blockchain.
158 4. Corrupt the chain.
159 5. Hide the corruption by repairing the chain
160 6. Exit
161 5
162 Repairing the entire chain
163 Total execution time required to repair the chain
    was 1086 milliseconds
164
165 0. View basic blockchain status
166 1. Add a transaction to blockchain.
167 2. Verify the blockchain.
168 3. View the blockchain.
169 4. Corrupt the chain.
170 5. Hide the corruption by repairing the chain
171 6. Exit
172 3
173 View the blockchain
174 {"ds_chain{" : [ {"index" : "0","time stamp" : "2021
    -10-23 15:54:25.55", "Tx" : "Carol pays Kanishka
    1000 dscoin", "PrevHash" : "", "nonce" : "554", "
    difficulty" : "2"}
175 {"index" : "1","time stamp" : "2021-10-23 15:54:41.
    006", "Tx" : "Kanishka pays Bob 100 dscoin", "
    PrevHash" : "
    003E0630E28D707C04E1DDAC9F44DB3D004001AF11DC2F7D2DF0
    73E5A4F46C79", "nonce" : "11066", "difficulty" : "3
    "}
176 {"index" : "2","time stamp" : "2021-10-23 15:54:54.
    298", "Tx" : "Bob pays Kanishka 20 dscoin", "
    PrevHash" : "
    0007C2DBF37BFC91D555564A8643ECC08861AD243B1EEE607DB5
    71E975361868", "nonce" : "5574", "difficulty" : "3"}
177 {"index" : "3","time stamp" : "2021-10-23 15:55:06.
    672", "Tx" : "Kanishka pays Carol 23 dscoin", "
    PrevHash" : "
    0003730A69DAB69A76E5241DB8697C6C39E10379AE6A276B8657
    5643FADB0B6F", "nonce" : "10217", "difficulty" : "4
    "}
178 {"index" : "4","time stamp" : "2021-10-23 15:55:20.

```

```

178 222", "Tx" : "Donna pays Kanishka 34 dscoin", "
    PrevHash" : "
    0000D64411944902FA0163EC0CB6A302429AE746421791FA28E3
    CF50BEE94409", "nonce" : "865806", "difficulty" : "5
    "}
179 {"index" : "5","time stamp" : "2021-10-23 15:55:35.
    833", "Tx" : "Carol pays Donna 1 dscoin", "PrevHash
    " : "
    00000A46BC499D04BCD083B9E3422EAFE0C32C6F5C8970CABD02
    88696C6A5FFB", "nonce" : "204", "difficulty" : "2"}
180 ],"chainHash": "
    009D6FA8F5D7003F3F7DBC76C9E3AC407FBC366BCF4E2C9D866F
    242EC8DD1551"}
181
182 0. View basic blockchain status
183 1. Add a transaction to blockchain.
184 2. Verify the blockchain.
185 3. View the blockchain.
186 4. Corrupt the chain.
187 5. Hide the corruption by repairing the chain
188 6. Exit
189 1
190 Enter difficulty > 0
191 4
192 Enter transaction
193 Edward pays Kanishka 34 dscoin
194 Total execution time to add this block was 0
    milliseconds
195
196 0. View basic blockchain status
197 1. Add a transaction to blockchain.
198 2. Verify the blockchain.
199 3. View the blockchain.
200 4. Corrupt the chain.
201 5. Hide the corruption by repairing the chain
202 6. Exit
203 2
204 Verifying the entire chain
205 Chain verification: true
206 Total execution time to verify the chain was 0
    milliseconds

```



```
207
208 0. View basic blockchain status
209 1. Add a transaction to blockchain.
210 2. Verify the blockchain.
211 3. View the blockchain.
212 4. Corrupt the chain.
213 5. Hide the corruption by repairing the chain
214 6. Exit
215 4
216 Corrupt the Blockchain
217 Enter the block ID of block to corrupt
218 2
219 Enter new data for block 2
220 Franks pays Kanishka 3 dscoin
221 Block 2 now holds Franks pays Kanishka 3 dscoin
222
223 0. View basic blockchain status
224 1. Add a transaction to blockchain.
225 2. Verify the blockchain.
226 3. View the blockchain.
227 4. Corrupt the chain.
228 5. Hide the corruption by repairing the chain
229 6. Exit
230 2
231 Verifying the entire chain
232 ..Improper hash at node2.Does not begin with 000
233 Chain verification: false
234 Total execution time to verify the chain was 1
    milliseconds
235
236 0. View basic blockchain status
237 1. Add a transaction to blockchain.
238 2. Verify the blockchain.
239 3. View the blockchain.
240 4. Corrupt the chain.
241 5. Hide the corruption by repairing the chain
242 6. Exit
243 5
244 Repairing the entire chain
245 Total execution time required to repair the chain
    was 653 milliseconds
```

```

246
247 0. View basic blockchain status
248 1. Add a transaction to blockchain.
249 2. Verify the blockchain.
250 3. View the blockchain.
251 4. Corrupt the chain.
252 5. Hide the corruption by repairing the chain
253 6. Exit
254 3
255 View the blockchain
256 {"ds_chain{" : [ {"index" : "0","time stamp" : "2021
-10-23 15:54:25.55", "Tx" : "Carol pays Kanishka
1000 dscoin", "PrevHash" : "", "nonce" : "554", "
difficulty" : "2"}
257 {"index" : "1","time stamp" : "2021-10-23 15:54:41.
006", "Tx" : "Kanishka pays Bob 100 dscoin", "
PrevHash" : "
003E0630E28D707C04E1DDAC9F44DB3D004001AF11DC2F7D2DF0
73E5A4F46C79", "nonce" : "11066", "difficulty" : "3
"}
258 {"index" : "2","time stamp" : "2021-10-23 15:54:54.
298", "Tx" : "Franks pays Kanishka 3 dscoin", "
PrevHash" : "
0007C2DBF37BFC91D555564A8643ECC08861AD243B1EEE607DB5
71E975361868", "nonce" : "12158", "difficulty" : "3
"}
259 {"index" : "3","time stamp" : "2021-10-23 15:55:06.
672", "Tx" : "Kanishka pays Carol 23 dscoin", "
PrevHash" : "
000F2DA646C1B0825AB7AED8FAE36C62DD81BF9A90D10F14AB1A
A329DD58D02C", "nonce" : "31984", "difficulty" : "4
"}
260 {"index" : "4","time stamp" : "2021-10-23 15:55:20.
222", "Tx" : "Donna pays Kanishka 34 dscoin", "
PrevHash" : "
000050ED58DD347D57E9D016C4A78140A61B4CDD4C86AC72F22F
0E962CC9A43C", "nonce" : "407401", "difficulty" : "5
"}
261 {"index" : "5","time stamp" : "2021-10-23 15:55:35.
833", "Tx" : "Carol pays Donna 1 dscoin", "PrevHash
" : "

```

```

261 000002A9FBED51C8DBD5078FC62B0A50701A82F78A38EB83E534
    610B98865E8B", "nonce" : "31", "difficulty" : "2"}
262 {"index" : "6", "time stamp" : "2021-10-23 15:56:20.
    402", "Tx" : "Edward pays Kanishka 34 dscoin", "
    PrevHash" : "
    0039C4D66D5D04D90AFC5ED1BCAFE3E9E64A62AA84D6CAA2FDAF
    26AA8303433A", "nonce" : "96267", "difficulty" : "4
    "}
263 ], "chainHash": "
    0000846CBE00A4AACF457C5D51C77BE74CEC9F5A160C3B90E00F
    02ABF58C7308"}
264
265 0. View basic blockchain status
266 1. Add a transaction to blockchain.
267 2. Verify the blockchain.
268 3. View the blockchain.
269 4. Corrupt the chain.
270 5. Hide the corruption by repairing the chain
271 6. Exit
272 2
273 Verifying the entire chain
274 Chain verification: true
275 Total execution time to verify the chain was 0
    milliseconds
276
277 0. View basic blockchain status
278 1. Add a transaction to blockchain.
279 2. Verify the blockchain.
280 3. View the blockchain.
281 4. Corrupt the chain.
282 5. Hide the corruption by repairing the chain
283 6. Exit
284 0
285 Current size of the chain: 7
286 Difficulty of the most recent block: 4
287 Total difficulty for all blocks: 23
288 Approximate hashes per second on this machine:
    2873563
289 Expected total hashes required for the whole chain:
    1188352.0

```

```
290 Nonce for the most recent block: 96267
291 Chain hash:
    0000846CBE00A4AACF457C5D51C77BE74CEC9F5A160C3B90E00F
    02ABF58C7308
292
293 0. View basic blockchain status
294 1. Add a transaction to blockchain.
295 2. Verify the blockchain.
296 3. View the blockchain.
297 4. Corrupt the chain.
298 5. Hide the corruption by repairing the chain
299 6. Exit
300 6
301
302 Process finished with exit code 0
303
```