List of full sensitivity spaced seeds for at most 5 mismatches

Valeriy Titarenko and Sofya Titarenko

Each spaced seed s is a periodic seed (b is a periodic block). It consists of n_b repetitions of the block and first n_d symbols of the blocks. Other parameters: w is the weight of the periodic seed, n_m is the maximum number of mismatches allowed to achieve the full sensitivity, L_{min} is the minimum length of a read required for the found seed.

We used the following selection criteria:

- by setting n_m and the length L of a read, we found all seeds of a maximum weight w;
- for a given weight w we found the shortest length L_{min} of reads when we are able to find seeds;
- among all seeds found for n_m , w and L_{min} , we used only seeds of maximum length.

If a seed s is found, then its reverse version \bar{s} (all digits are in the reverse order) can also be used. To form the seeds below lists of seed blocks b were used. Those blocks were found for sizes from 10 to 50 for $n_m = 3, 4, \ldots, 9$ and from 10 to 70 for $n_m = 2$. For each block size only sequences of maximum weight were used. There is a possibility that in a future longer seed blocks can be found and new spaced seeds can be formed for a given weight w (it will be possible to use them for shorter reads, i.e. L_{min} will be smaller).

```
1) n_m = 5, w = 16, L_{min} = 62, n_b = 1, n_d = 11,
  b = 1110011010100000100100000,
  s = 111001101010000010010000011100110101
2) n_m = 5, w = 17, L_{min} = 66, n_b = 1, n_d = 15,
  b = 10010110001110100000001000
  s = 1001011000111010000001000100101100011101
3) n_m = 5, w = 18, L_{min} = 70, n_b = 1, n_d = 19,
  b = 10001001011000111010000000
  s = 100010010110001110100000001000100101100011101
4) n_m = 5, w = 19, L_{min} = 74, n_b = 4, n_d = 5,
  b = 1010100001000,
  5) n_m = 5, w = 20, L_{min} = 76, n_b = 1, n_d = 15,
  6) n_m = 5, w = 21, L_{min} = 79, n_b = 2, n_d = 11,
  7) n_m = 5, w = 22, L_{min} = 82, n_b = 2, n_d = 5,
  b = 11101000000010001001011000,
  8) n_m = 5, w = 23, L_{min} = 84, n_b = 2, n_d = 7,
  b = 1110011010100000100100000,
  9) n_m = 5, w = 24, L_{min} = 86, n_b = 2, n_d = 9,
  b = 1110011010100000100100000,
  10) n_m = 5, w = 25, L_{min} = 88, n_b = 2, n_d = 11,
```

b = 1110011010100000100100000

- 14) $n_m = 5$, w = 29, $L_{min} = 104$, $n_b = 3$, $n_d = 9$, b = 101000111000001000011000,

40) $n_m = 5$, w = 44, $L_{min} = 144$, $n_b = 4$, $n_d = 15$,

b = 10010110001110100000001000,

- 41) $n_m = 5$, w = 45, $L_{min} = 148$, $n_b = 4$, $n_d = 19$,

b = 10001001011000111010000000,

42) $n_m = 5$, w = 46, $L_{min} = 153$, $n_b = 3$, $n_d = 10$,

b = 110110110100010010010000010010010000

43) $n_m = 5$, w = 47, $L_{min} = 156$, $n_b = 3$, $n_d = 13$,

b = 101001101101100000100100100000100100,

44) $n_m = 5$, w = 47, $L_{min} = 156$, $n_b = 3$, $n_d = 13$,

b = 110010110110100000100100100000100100

45) $n_m = 5$, w = 47, $L_{min} = 156$, $n_b = 3$, $n_d = 13$,

b = 101101001101100100000100100100000100

46) $n_m = 5$, w = 48, $L_{min} = 158$, $n_b = 5$, $n_d = 3$,

b = 11101000000010001001011000.

47) $n_m = 5$, w = 48, $L_{min} = 158$, $n_h = 5$, $n_d = 3$,

b = 1110011010100000100100000,

48) $n_m = 5$, w = 49, $L_{min} = 160$, $n_b = 5$, $n_d = 5$,

b = 1110100000010001001011000

49) $n_m = 5$, w = 50, $L_{min} = 162$, $n_b = 5$, $n_d = 7$,

b = 1110011010100000100100000.

50) $n_m = 5$, w = 51, $L_{min} = 164$, $n_b = 5$, $n_d = 9$,

b = 1110011010100000100100000

51) $n_m = 5$, w = 52, $L_{min} = 166$, $n_b = 5$, $n_d = 11$,

b = 1110011010100000100100000

52) $n_m = 5$, w = 53, $L_{min} = 170$, $n_b = 5$, $n_d = 15$,

b = 10010110001110100000001000

53) $n_m = 5$, w = 54, $L_{min} = 174$, $n_b = 5$, $n_d = 19$,

b = 10001001011000111010000000,

54) $n_m = 5$, w = 55, $L_{min} = 180$, $n_b = 3$, $n_d = 29$,

b = 10101000101000101010101010101010000000,

55) $n_m = 5$, w = 55, $L_{min} = 180$, $n_b = 3$, $n_d = 29$,

b = 10100010100010101010101010101000000010

56) $n_m = 5$, w = 55, $L_{min} = 180$, $n_b = 3$, $n_d = 29$,

b = 100010101010101010101010101010100001000

57) $n_m = 5$, w = 55, $L_{min} = 180$, $n_b = 3$, $n_d = 29$,

b = 10101000101010101010101010101000001000

58) $n_m = 5$, w = 55, $L_{min} = 180$, $n_b = 3$, $n_d = 29$,

b = 10101010100010101010100010101000001000

59) $n_m = 5$, w = 55, $L_{min} = 180$, $n_b = 3$, $n_d = 29$,

b = 101010101010101010101010101010100001000

60) $n_m = 5$, w = 56, $L_{min} = 182$, $n_b = 3$, $n_d = 31$,

61) $n_m = 5$, w = 57, $L_{min} = 184$, $n_b = 6$, $n_d = 3$,

b = 111010000001001001011000

62) $n_m = 5$, w = 57, $L_{min} = 184$, $n_b = 6$, $n_d = 3$,

b = 1110011010100000100100000,

63) $n_m = 5$, w = 58, $L_{min} = 186$, $n_b = 6$, $n_d = 5$,

b = 11101000000010001001011000

64) $n_m = 5$, w = 59, $L_{min} = 188$, $n_b = 6$, $n_d = 7$,

b = 1110011010100000100100000

65) $n_m = 5$, w = 60, $L_{min} = 190$, $n_b = 6$, $n_d = 9$,

b = 1110011010100000100100000,

66) $n_m = 5$, w = 61, $L_{min} = 192$, $n_b = 6$, $n_d = 11$,

b = 1110011010100000100100000,

67) $n_m = 5$, w = 62, $L_{min} = 196$, $n_b = 6$, $n_d = 15$,

b = 10010110001110100000001000,

68) $n_m = 5$, w = 63, $L_{min} = 200$, $n_b = 6$, $n_d = 19$,

b = 10001001011000111010000000,

69) $n_m = 5$, w = 64, $L_{min} = 204$, $n_b = 4$, $n_d = 15$,

b = 10101010101010101000000010101000101000,

70) $n_m = 5$, w = 64, $L_{min} = 204$, $n_b = 4$, $n_d = 15$,

b = 10101010101010100000001010100010100010

71) $n_m = 5$, w = 64, $L_{min} = 204$, $n_b = 4$, $n_d = 15$,

72) $n_m = 5$, w = 64, $L_{min} = 204$, $n_b = 4$, $n_d = 15$,

73) $n_m = 5$, w = 64, $L_{min} = 204$, $n_b = 4$, $n_d = 15$,

b = 101010101010101010001001010100000101000

74) $n_m = 5$, w = 65, $L_{min} = 206$, $n_b = 4$, $n_d = 17$,

b = 10101010101010101000000010101000101000,

75) $n_m = 5$, w = 65, $L_{min} = 206$, $n_b = 4$, $n_d = 17$,

76) $n_m = 5$, w = 66, $L_{min} = 210$, $n_b = 7$, $n_d = 3$,

b = 11101000000010001001011000

77) $n_m = 5$, w = 66, $L_{min} = 210$, $n_b = 7$, $n_d = 3$,

b = 1110011010100000100100000

78) $n_m = 5$, w = 67, $L_{min} = 212$, $n_b = 7$, $n_d = 5$,

b = 11101000000010001001011000,

102) $n_m = 5$, w = 81, $L_{min} = 249$, $n_b = 4$, $n_d = 25$,

- 103) $n_m = 5$, w = 81, $L_{min} = 249$, $n_b = 4$, $n_d = 25$,

- 104) $n_m = 5$, w = 81, $L_{min} = 249$, $n_b = 4$, $n_d = 25$,

105) $n_m = 5$, w = 81, $L_{min} = 249$, $n_b = 4$, $n_d = 25$,

106) $n_m = 5$, w = 81, $L_{min} = 249$, $n_b = 4$, $n_d = 25$,

107) $n_m = 5$, w = 81, $L_{min} = 249$, $n_b = 4$, $n_d = 25$,

108) $n_m = 5$, w = 81, $L_{min} = 249$, $n_b = 4$, $n_d = 25$,

109) $n_m = 5$, w = 81, $L_{min} = 249$, $n_b = 4$, $n_d = 25$,

110) $n_m = 5$, w = 82, $L_{min} = 252$, $n_b = 5$, $n_d = 25$,

111) $n_m = 5$, w = 83, $L_{min} = 256$, $n_b = 5$, $n_d = 29$,

b = 10101000101000101010101010101010000000

112) $n_m = 5$, w = 83, $L_{min} = 256$, $n_b = 5$, $n_d = 29$,

b = 10100010100010101010101010101000000010,

- 113) $n_m = 5$, w = 83, $L_{min} = 256$, $n_b = 5$, $n_d = 29$,
 - b = 100010101010101010101010101010100001000,
- 114) $n_m = 5$, w = 83, $L_{min} = 256$, $n_b = 5$, $n_d = 29$,
 - b = 10101000101010101010101010101000001000
- 115) $n_m = 5$, w = 83, $L_{min} = 256$, $n_b = 5$, $n_d = 29$,
 - b = 1010101010101010101010101010100001000.
- 116) $n_m = 5$, w = 83, $L_{min} = 256$, $n_b = 5$, $n_d = 29$,
 - b = 1010101010101000101010101010100001000
- 117) $n_m = 5$, w = 84, $L_{min} = 258$, $n_b = 5$, $n_d = 31$,
 - b = 10101000101000101010101010101010000000
- 118) $n_m = 5$, w = 85, $L_{min} = 260$, $n_b = 5$, $n_d = 9$,
- 119) $n_m = 5$, w = 85, $L_{min} = 260$, $n_b = 5$, $n_d = 9$,
 - b = 1010101010101010100010010101010000010100010
- 120) $n_m = 5$, w = 85, $L_{min} = 260$, $n_b = 5$, $n_d = 9$,
- 121) $n_m = 5$, w = 85, $L_{min} = 260$, $n_b = 5$, $n_d = 9$,
- 122) $n_m = 5$, w = 85, $L_{min} = 260$, $n_b = 5$, $n_d = 9$,

- 134) $n_m = 5$, w = 90, $L_{min} = 272$, $n_b = 5$, $n_d = 21$,
- 135) $n_m = 5$, w = 90, $L_{min} = 272$, $n_b = 5$, $n_d = 21$,
- 136) $n_m = 5$, w = 91, $L_{min} = 274$, $n_b = 5$, $n_d = 23$,
- 137) $n_m = 5$, w = 92, $L_{min} = 278$, $n_b = 5$, $n_d = 27$,
- 138) $n_m = 5$, w = 92, $L_{min} = 278$, $n_b = 5$, $n_d = 27$,
- 139) $n_m = 5$, w = 92, $L_{min} = 278$, $n_b = 5$, $n_d = 27$,
 - b = 1010101010101010100010010101010000010100010
- 140) $n_m = 5$, w = 92, $L_{min} = 278$, $n_b = 5$, $n_d = 27$,
- 141) $n_m = 5$, w = 93, $L_{min} = 280$, $n_b = 5$, $n_d = 29$,
- 142) $n_m = 5$, w = 93, $L_{min} = 280$, $n_b = 5$, $n_d = 29$,
 - b = 101010101010101000100010101010000010100010,
- 143) $n_m = 5$, w = 94, $L_{min} = 282$, $n_b = 5$, $n_d = 31$,

144) $n_m = 5$, w = 95, $L_{min} = 285$, $n_b = 5$, $n_d = 16$,

b = 1010011011011011000001001001001000001001001001001

145) $n_m = 5$, w = 95, $L_{min} = 285$, $n_b = 5$, $n_d = 16$,

146) $n_m = 5$, w = 95, $L_{min} = 285$, $n_b = 5$, $n_d = 16$,

b = 101101001101101100100000100100100100000100100,

147) $n_m = 5$, w = 95, $L_{min} = 285$, $n_b = 5$, $n_d = 16$,

b = 110110010110110100100000100100100100000100100,

148) $n_m = 5$, w = 96, $L_{min} = 288$, $n_b = 5$, $n_d = 37$,

149) $n_m = 5$, w = 97, $L_{min} = 291$, $n_b = 5$, $n_d = 22$,

150) $n_m = 5$, w = 97, $L_{min} = 291$, $n_b = 5$, $n_d = 22$,

151) $n_m = 5$, w = 97, $L_{min} = 291$, $n_b = 5$, $n_d = 22$,

152) $n_m = 5$, w = 97, $L_{min} = 291$, $n_b = 5$, $n_d = 22$,

153) $n_m = 5$, w = 97, $L_{min} = 291$, $n_b = 5$, $n_d = 22$,

154) $n_m = 5$, w = 97, $L_{min} = 291$, $n_b = 5$, $n_d = 22$,

- 155) $n_m = 5$, w = 97, $L_{min} = 291$, $n_b = 5$, $n_d = 22$,
- 156) $n_m = 5$, w = 97, $L_{min} = 291$, $n_b = 5$, $n_d = 22$,
- 157) $n_m = 5$, w = 98, $L_{min} = 294$, $n_b = 5$, $n_d = 25$,
- 158) $n_m = 5$, w = 98, $L_{min} = 294$, $n_b = 5$, $n_d = 25$,
- 159) $n_m = 5$, w = 98, $L_{min} = 294$, $n_b = 5$, $n_d = 25$,
- 160) $n_m = 5$, w = 98, $L_{min} = 294$, $n_b = 5$, $n_d = 25$,
- 161) $n_m = 5$, w = 98, $L_{min} = 294$, $n_b = 5$, $n_d = 25$,
- 162) $n_m = 5$, w = 98, $L_{min} = 294$, $n_b = 5$, $n_d = 25$,
- 163) $n_m = 5$, w = 98, $L_{min} = 294$, $n_b = 5$, $n_d = 25$,
- 164) $n_m = 5$, w = 98, $L_{min} = 294$, $n_b = 5$, $n_d = 25$,

165) $n_m = 5$, w = 99, $L_{min} = 298$, $n_b = 6$, $n_d = 5$,

166) $n_m = 5$, w = 99, $L_{min} = 298$, $n_b = 6$, $n_d = 5$,

b = 1010101010101010100010010101010000010100010,

167) $n_m = 5$, w = 99, $L_{min} = 298$, $n_b = 6$, $n_d = 5$,

168) $n_m = 5$, w = 99, $L_{min} = 298$, $n_b = 6$, $n_d = 5$,

169) $n_m = 5$, w = 99, $L_{min} = 298$, $n_b = 6$, $n_d = 5$,

170) $n_m = 5$, w = 99, $L_{min} = 298$, $n_b = 6$, $n_d = 5$,

171) $n_m = 5$, w = 99, $L_{min} = 298$, $n_b = 6$, $n_d = 5$,

172) $n_m = 5$, w = 99, $L_{min} = 298$, $n_b = 6$, $n_d = 5$,

173) $n_m = 5$, w = 99, $L_{min} = 298$, $n_b = 6$, $n_d = 5$,

b = 101010000010100010101010101010101000100010

174) $n_m = 5$, w = 100, $L_{min} = 300$, $n_b = 6$, $n_d = 7$,

175) $n_m = 5$, w = 100, $L_{min} = 300$, $n_b = 6$, $n_d = 7$,

- 176) $n_m = 5$, w = 100, $L_{min} = 300$, $n_b = 6$, $n_d = 7$,
- 177) $n_m = 5$, w = 100, $L_{min} = 300$, $n_b = 6$, $n_d = 7$,
- 178) $n_m = 5$, w = 100, $L_{min} = 300$, $n_b = 6$, $n_d = 7$,
- 179) $n_m = 5$, w = 100, $L_{min} = 300$, $n_b = 6$, $n_d = 7$,
- 180) $n_m = 5$, w = 100, $L_{min} = 300$, $n_b = 6$, $n_d = 7$,
- 181) $n_m = 5$, w = 101, $L_{min} = 302$, $n_b = 6$, $n_d = 9$,
- 182) $n_m = 5$, w = 101, $L_{min} = 302$, $n_b = 6$, $n_d = 9$,
- 183) $n_m = 5$, w = 101, $L_{min} = 302$, $n_b = 6$, $n_d = 9$,
- 184) $n_m = 5$, w = 101, $L_{min} = 302$, $n_b = 6$, $n_d = 9$,
- 185) $n_m = 5$, w = 101, $L_{min} = 302$, $n_b = 6$, $n_d = 9$,

186) $n_m = 5$, w = 102, $L_{min} = 304$, $n_b = 6$, $n_d = 11$,

187) $n_m = 5$, w = 102, $L_{min} = 304$, $n_b = 6$, $n_d = 11$,

b = 1010101010101010100010010101010000010100010,

188) $n_m = 5$, w = 102, $L_{min} = 304$, $n_b = 6$, $n_d = 11$,

189) $n_m = 5$, w = 102, $L_{min} = 304$, $n_b = 6$, $n_d = 11$,

190) $n_m = 5$, w = 103, $L_{min} = 306$, $n_b = 6$, $n_d = 13$,

191) $n_m = 5$, w = 103, $L_{min} = 306$, $n_b = 6$, $n_d = 13$,

b = 101010101010101000100010101010000010100010,

192) $n_m = 5$, w = 103, $L_{min} = 306$, $n_b = 6$, $n_d = 13$,

193) $n_m = 5$, w = 104, $L_{min} = 308$, $n_b = 6$, $n_d = 15$,

194) $n_m = 5$, w = 104, $L_{min} = 308$, $n_b = 6$, $n_d = 15$,

b = 1010101010101010100010010101010000010100010,

195) $n_m = 5$, w = 105, $L_{min} = 310$, $n_b = 6$, $n_d = 17$,

196) $n_m = 5$, w = 106, $L_{min} = 314$, $n_b = 6$, $n_d = 21$,

- 197) $n_m = 5$, w = 106, $L_{min} = 314$, $n_b = 6$, $n_d = 21$,
- 198) $n_m = 5$, w = 106, $L_{min} = 314$, $n_b = 6$, $n_d = 21$,
- 199) $n_m = 5$, w = 107, $L_{min} = 316$, $n_b = 6$, $n_d = 23$,
- 200) $n_m = 5$, w = 108, $L_{min} = 320$, $n_b = 6$, $n_d = 27$,
- 201) $n_m = 5$, w = 108, $L_{min} = 320$, $n_b = 6$, $n_d = 27$,
- 202) $n_m = 5$, w = 108, $L_{min} = 320$, $n_b = 6$, $n_d = 27$,
 - b = 1010101010101010100010010101010000010100010
- 203) $n_m = 5$, w = 108, $L_{min} = 320$, $n_b = 6$, $n_d = 27$,
- 204) $n_m = 5$, w = 109, $L_{min} = 322$, $n_b = 6$, $n_d = 29$,
- 205) $n_m = 5$, w = 109, $L_{min} = 322$, $n_b = 6$, $n_d = 29$,
 - b = 1010101010101010100010010101010000010100010,
- 206) $n_m = 5$, w = 110, $L_{min} = 324$, $n_b = 6$, $n_d = 31$,

207) $n_m = 5$, w = 111, $L_{min} = 327$, $n_b = 6$, $n_d = 13$,

208) $n_m = 5$, w = 112, $L_{min} = 330$, $n_b = 6$, $n_d = 37$,

209) $n_m = 5$, w = 113, $L_{min} = 333$, $n_b = 6$, $n_d = 19$,

b = 100101001101101101100000100100100100000100100,

210) $n_m = 5$, w = 113, $L_{min} = 333$, $n_b = 6$, $n_d = 19$,

b = 100110010110110110100000100100100100000100100,

211) $n_m = 5$, w = 113, $L_{min} = 333$, $n_b = 6$, $n_d = 19$,

212) $n_m = 5$, w = 113, $L_{min} = 333$, $n_b = 6$, $n_d = 19$,

213) $n_m = 5$, w = 113, $L_{min} = 333$, $n_b = 6$, $n_d = 19$,

214) $n_m = 5$, w = 113, $L_{min} = 333$, $n_b = 6$, $n_d = 19$,

b = 110110010110110100100000100100100100000100100,

215) $n_m = 5$, w = 114, $L_{min} = 336$, $n_b = 6$, $n_d = 22$,

216) $n_m = 5$, w = 114, $L_{min} = 336$, $n_b = 6$, $n_d = 22$,

217) $n_m = 5$, w = 114, $L_{min} = 336$, $n_b = 6$, $n_d = 22$,

218) $n_m = 5$, w = 114, $L_{min} = 336$, $n_b = 6$, $n_d = 22$,

219) $n_m = 5$, w = 114, $L_{min} = 336$, $n_b = 6$, $n_d = 22$,

220) $n_m = 5$, w = 114, $L_{min} = 336$, $n_b = 6$, $n_d = 22$,

221) $n_m = 5$, w = 114, $L_{min} = 336$, $n_b = 6$, $n_d = 22$,

222) $n_m = 5$, w = 114, $L_{min} = 336$, $n_b = 6$, $n_d = 22$,

223) $n_m = 5$, w = 115, $L_{min} = 339$, $n_b = 6$, $n_d = 25$,

224) $n_m = 5$, w = 115, $L_{min} = 339$, $n_b = 6$, $n_d = 25$,

225) $n_m = 5$, w = 115, $L_{min} = 339$, $n_b = 6$, $n_d = 25$,

226) $n_m = 5$, w = 115, $L_{min} = 339$, $n_b = 6$, $n_d = 25$,

227) $n_m = 5$, w = 115, $L_{min} = 339$, $n_b = 6$, $n_d = 25$,

228) $n_m = 5$, w = 115, $L_{min} = 339$, $n_b = 6$, $n_d = 25$,

229) $n_m = 5$, w = 115, $L_{min} = 339$, $n_b = 6$, $n_d = 25$,

230) $n_m = 5$, w = 115, $L_{min} = 339$, $n_b = 6$, $n_d = 25$,

231) $n_m = 5$, w = 116, $L_{min} = 342$, $n_b = 7$, $n_d = 7$,

232) $n_m = 5$, w = 116, $L_{min} = 342$, $n_b = 7$, $n_d = 7$,

b = 101010101010101000100010101010000010100010,

233) $n_m = 5$, w = 116, $L_{min} = 342$, $n_b = 7$, $n_d = 7$,

234) $n_m = 5$, w = 116, $L_{min} = 342$, $n_b = 7$, $n_d = 7$,

235) $n_m = 5$, w = 116, $L_{min} = 342$, $n_b = 7$, $n_d = 7$,

236) $n_m = 5$, w = 116, $L_{min} = 342$, $n_b = 7$, $n_d = 7$,

237) $n_m = 5$, w = 116, $L_{min} = 342$, $n_b = 7$, $n_d = 7$,

238) $n_m = 5$, w = 117, $L_{min} = 344$, $n_b = 7$, $n_d = 9$,

239) $n_m = 5$, w = 117, $L_{min} = 344$, $n_b = 7$, $n_d = 9$,

240) $n_m = 5$, w = 117, $L_{min} = 344$, $n_b = 7$, $n_d = 9$,

241) $n_m = 5$, w = 117, $L_{min} = 344$, $n_b = 7$, $n_d = 9$,

242) $n_m = 5$, w = 117, $L_{min} = 344$, $n_b = 7$, $n_d = 9$,

243) $n_m = 5$, w = 118, $L_{min} = 346$, $n_b = 7$, $n_d = 11$,

244) $n_m = 5$, w = 118, $L_{min} = 346$, $n_b = 7$, $n_d = 11$,

b = 1010101010101010100010010101010000010100010

245) $n_m = 5$, w = 118, $L_{min} = 346$, $n_b = 7$, $n_d = 11$,

246) $n_m = 5$, w = 118, $L_{min} = 346$, $n_b = 7$, $n_d = 11$,

247) $n_m = 5$, w = 119, $L_{min} = 348$, $n_b = 7$, $n_d = 13$,

248) $n_m = 5$, w = 119, $L_{min} = 348$, $n_b = 7$, $n_d = 13$,

249) $n_m = 5$, w = 119, $L_{min} = 348$, $n_b = 7$, $n_d = 13$,

250) $n_m = 5$, w = 120, $L_{min} = 350$, $n_b = 7$, $n_d = 15$,

251) $n_m = 5$, w = 120, $L_{min} = 350$, $n_b = 7$, $n_d = 15$,

252) $n_m = 5$, w = 121, $L_{min} = 352$, $n_b = 7$, $n_d = 17$,

253) $n_m = 5$, w = 122, $L_{min} = 356$, $n_b = 7$, $n_d = 21$,

254) $n_m = 5$, w = 122, $L_{min} = 356$, $n_b = 7$, $n_d = 21$,

255) $n_m = 5$, w = 122, $L_{min} = 356$, $n_b = 7$, $n_d = 21$,

256) $n_m = 5$, w = 123, $L_{min} = 358$, $n_b = 7$, $n_d = 23$,

257) $n_m = 5$, w = 124, $L_{min} = 362$, $n_b = 7$, $n_d = 27$,

258) $n_m = 5$, w = 124, $L_{min} = 362$, $n_b = 7$, $n_d = 27$,

259) $n_m = 5$, w = 124, $L_{min} = 362$, $n_b = 7$, $n_d = 27$,

b = 101010101010101000100010101010000010100010,

260) $n_m = 5$, w = 124, $L_{min} = 362$, $n_b = 7$, $n_d = 27$,

261) $n_m = 5$, w = 125, $L_{min} = 364$, $n_b = 7$, $n_d = 29$,

262) $n_m = 5$, w = 125, $L_{min} = 364$, $n_b = 7$, $n_d = 29$,

b = 1010101010101010100010010101010000010100010,

263) $n_m = 5$, w = 126, $L_{min} = 366$, $n_b = 7$, $n_d = 31$,

264) $n_m = 5$, w = 127, $L_{min} = 370$, $n_b = 7$, $n_d = 35$,

265) $n_m = 5$, w = 127, $L_{min} = 370$, $n_b = 7$, $n_d = 35$,

266) $n_m = 5$, w = 127, $L_{min} = 370$, $n_b = 7$, $n_d = 35$,

b = 101010100000101000101010101010101010001000

267) $n_m = 5$, w = 128, $L_{min} = 372$, $n_b = 7$, $n_d = 37$,

268) $n_m = 5$, w = 129, $L_{min} = 375$, $n_b = 7$, $n_d = 16$,

269) $n_m = 5$, w = 129, $L_{min} = 375$, $n_b = 7$, $n_d = 16$,

b = 1100101101101101000001001001001000001001001001001

270) $n_m = 5$, w = 129, $L_{min} = 375$, $n_b = 7$, $n_d = 16$,

b = 101101001101101100100000100100100100000100100

280) $n_m = 5$, w = 131, $L_{min} = 381$, $n_b = 7$, $n_d = 22$,

281) $n_m = 5$, w = 131, $L_{min} = 381$, $n_b = 7$, $n_d = 22$,

282) $n_m = 5$, w = 131, $L_{min} = 381$, $n_b = 7$, $n_d = 22$,

283) $n_m = 5$, w = 131, $L_{min} = 381$, $n_b = 7$, $n_d = 22$,

284) $n_m = 5$, w = 131, $L_{min} = 381$, $n_b = 7$, $n_d = 22$,

285) $n_m = 5$, w = 131, $L_{min} = 381$, $n_b = 7$, $n_d = 22$,

286) $n_m = 5$, w = 132, $L_{min} = 384$, $n_b = 8$, $n_d = 7$,

287) $n_m = 5$, w = 132, $L_{min} = 384$, $n_b = 8$, $n_d = 7$,

b = 1010101010101010100010010101010000010100010,

288) $n_m = 5$, w = 132, $L_{min} = 384$, $n_b = 8$, $n_d = 7$,

289) $n_m = 5$, w = 132, $L_{min} = 384$, $n_b = 8$, $n_d = 7$,

290) $n_m = 5$, w = 132, $L_{min} = 384$, $n_b = 8$, $n_d = 7$,

291) $n_m = 5$, w = 132, $L_{min} = 384$, $n_b = 8$, $n_d = 7$,

292) $n_m = 5$, w = 132, $L_{min} = 384$, $n_b = 8$, $n_d = 7$,

293) $n_m = 5$, w = 133, $L_{min} = 386$, $n_b = 8$, $n_d = 9$,

294) $n_m = 5$, w = 133, $L_{min} = 386$, $n_b = 8$, $n_d = 9$,

295) $n_m = 5$, w = 133, $L_{min} = 386$, $n_b = 8$, $n_d = 9$,

296) $n_m = 5$, w = 133, $L_{min} = 386$, $n_b = 8$, $n_d = 9$,

297) $n_m = 5$, w = 133, $L_{min} = 386$, $n_b = 8$, $n_d = 9$,

298) $n_m = 5$, w = 134, $L_{min} = 388$, $n_b = 8$, $n_d = 11$,

299) $n_m = 5$, w = 134, $L_{min} = 388$, $n_b = 8$, $n_d = 11$,

300) $n_m = 5$, w = 134, $L_{min} = 388$, $n_b = 8$, $n_d = 11$,

301) $n_m = 5$, w = 134, $L_{min} = 388$, $n_b = 8$, $n_d = 11$,

302) $n_m = 5$, w = 135, $L_{min} = 390$, $n_b = 8$, $n_d = 13$,

303) $n_m = 5$, w = 135, $L_{min} = 390$, $n_b = 8$, $n_d = 13$,

b = 1010101010101010100010010101010000010100010

304) $n_m = 5$, w = 135, $L_{min} = 390$, $n_b = 8$, $n_d = 13$,

305) $n_m = 5$, w = 136, $L_{min} = 392$, $n_b = 8$, $n_d = 15$,

306) $n_m = 5$, w = 136, $L_{min} = 392$, $n_b = 8$, $n_d = 15$,

307) $n_m = 5$, w = 137, $L_{min} = 394$, $n_b = 8$, $n_d = 17$,

308) $n_m = 5$, w = 138, $L_{min} = 398$, $n_b = 8$, $n_d = 21$,

309) $n_m = 5$, w = 138, $L_{min} = 398$, $n_b = 8$, $n_d = 21$,

310) $n_m = 5$, w = 138, $L_{min} = 398$, $n_b = 8$, $n_d = 21$,

311) $n_m = 5$, w = 139, $L_{min} = 400$, $n_b = 8$, $n_d = 23$,