PiXL
Partners in excellence

GCSE Computer Science

Booster Pack (Answers)

Commissioned by The PiXL Club Ltd.

Relational Operators

Exercise A

1 **a.** True **b**. False 5 < 12 **c**. True **d** .True **e.** False 17> 2 + 3

f . False 20 - 5 < 16 **g**. True **h**. True **i.** True **j**. False 2 + 5 + 7 < 20 - 4 – 1

2 **a**. 3 < 6 **b**. 10 > 8 **c**. 25 < 27 **d.** -8 <8

e. 13 < 62 **f.** 42 >6 **g.** 19 > -29 **h.** 0 > -5

3 **a.** 10 > 7 + 2 **b**. 25 - 10 < 8 + 8 **c.** 2 * 3 < 1 + 6

d. 25> 48 – 25 **e.** -5> 8 – 14 **f.** -10 < 46 – 47

g. -11 > -3 - 9 **h.** 22 / 2 < 3 * 4 **i.** 11 / 2 < 7 * 5

4 **a.** True **b.** False 14 == 7 * 2 **c.** False 13 ≠31 – 17

d. True **e.** True **f .** False 23-30 != -6

g. False -7 ≠ -3 - 7 **h.** True **i .** True

5 **a.** 10 ==7 + 3 **b.** 16 == 48 / 3 **c.** 24 == 6 * 4

d. 18 ≠ 34 – 25 **e.** -11 ≠ 8 – 14 **f.** -10 == 33 – 43

g. -9 ≠ 4 - 14 **h.** 13 == 52 / 4 **i.** 22 + 26 == 12 * 4

6 **a.** True **b.** True **c.** True

d. True **e.** False -5≥ 8 – 14 **f.** True

g. True **h.** False 15 ≤ 34 / 2 **i.** True

7 **a**. 19 ≥ 11 + 7 **b.** 20 – 4 ≤ 12 + 6 **c.** 13 ≥ 14 – 17

d. 7 ≥32 – 25 **e.** -5 ≤ 12 – 14 **f.** -10 ≤ 46 – 47

g. -9 ≥ -3 -9 **h.** 16 ≥ 80 / 5 **i.** 48 ≥ 12 * 3

Arithmetic Operators

Exercise A

1 **a.** 75 **b.** 60 **c.** 9 **d.** 5 **e.** 12 **f.** 84 **g.** 10 **h.** 62 **i.** 64 **j.** 37

2 **a.** 6 * 6 = 36 **b.** 80 /8 = 10 **c.** 25 +27 = 52 **d.** -8 + 8 = 0

e. 13 + 49 = 62 **f.** 42 / 2 = 21 **g.** 15 * 4 = 60 **h.** 0 - 5 = -5

Exercise B

1 **a.** 37/4=9r1 **b.** 55/3=18r1 **c.** 60/2=30 r0 **d.** 48/5=9r3 **e.** 82/3=27r1 **f.** 77/2=38r1

g. 100/4=25r0 **h.** 62/3=20r2 **i.** 64/3=21r1 **j.** 82/5=16r2 **k.** 49/4=12r1 **l.** 88/9=9r7

2

a. 116/5=23r1 **b.** 121/7=17r2 **c.** 111/2=55r1 **d.** 148/5=21r3 **e.** 157/3=52r1 **f.** 166/8=20r6

g. 119/4=29r3 **h.** 232/7=33r1 **i.** 199/6=33r **j.** 187/6=31r1 **k.** 195/4=48r3 **l.** 255/9=28r3

Exercise C

1 **a.** 2 **b.** 2 **c.** 2 **d.** 1 **e.** 1 **f.** 0 **g.** 2 **h.** 3 **i.** 4 **j.** 0 **k.** 2 **l.** 4

2 **a.** 0 **b .** 6 **c.** 0 **d.** 3 e. 3 **f.** 2 **g.** 3 **h.** 2 **i.** 5 **j .**1 **k.** 3 **l .** 3

Exercise D

1 **a.** 7 **b.** 7 **c.** 12 **d.** 5 **e.** 14 **f.** 9 **g.** 14 **h.** 5 **i.** 18 **j.** 9 **k .** 15 **l.** 14

2 **a.** 18 **b.** 22 **c.** 19 **d.** 35 **e.** 39 **f.** 21 **g.** 18 **h.** 80 **i.** 41 **j.** 31 **k.** 48 **l.** 41

3

15 / 4	6	3
29 / 5	8	2
36 / 6	5	1
34 / 16	3	0
25 / 3	2	4

Number Systems and Conversions

Exercise A

1 **a.** 3 **b.** 30 **c.** 3000 **d.** 3 **e.** 300 **f.** 30 **g.** 3000 **h.** 3 000 000 **i.** 300 000 **j.** 3 000

2 **a.** True

b. True

c. False 900 is ten times larger than 90x

d. True

e. True

f. False 60 is one hundred times smaller than 6 000

g. True

h. False 800 is one hundred times smaller than 80 000

3 **a.** 10 **b.** 10 **c.** 10 **d.** 100 **e.** 1000 **f .** 10 **g.** 100 **h.** 100 **i.** 100

4 **a.** 100 **b.** 10 **c.** 1000 **d.** 10 000 **e.** 10 **f.** 1000 **g.** 100 **h.** 100 **i.** 1000

5 7 70 700 7000 70000 7000000

6 **a.** 100 **b.** 10000 **c.** 1 **d.** 100000 **e.** 10 **f.** 1000

7 **a.** 10^3 **b.** 10^0 **c.** 10^2 **d.** 10^4 **e.** 10^5 **f.** 10^6

8

10 000	10^4
100	10^2
1 000	10^3
1 000 000	10^6
10	10^1
100000	10^5
10^0	

Exercise B

1 **a**. False. Binary only has 0 and 1 and this number has other digits.

b. False. 2 is not a binary digit.

c. True

d. False. Could be binary as it has 1 and 0 only. Cannot tell which base it is.

e. True

2 **a.** 2 **b.** 8 **c**. 64 **d.** 4 and 1 **e.** 8 and 2 **f.** 4 and 2 **g.** 64 and 32 **h.** 32 and 1 **i.** 128 and 64 **j.** 16 and 2

3 **a**. True

b. False. 100 is <u>two</u> times as large as 10.

c. True

d. False. 10 is <u>8</u> times smaller than 10000.

e. True

f. True.

4

16	2^4
1	2^0
64	2^6
32	2^5
8	2^3
128	2^7
2	2^1
	2^2

Exercise C

1 **a.** 1010 **b.** 1111 **c.** 10000 **d.** 11000 **e.** 11110 **f.** 1100100

g. 11010100 **h.** 1001110 **i.** 11001000 **j.** 10010010 **k.** 11100110 **l.** 11111111

2 **a.** 11111 **b.** 110001 **c .** 101010 **d.** 10101

e. 100000 **f.** 10100 **g.** 1000000 **h.** 11010

i. 1011000 **j.** 11111111

3 **a.** 1000000 **b.** 1111000 **c.** 110001 **d.** 1100

e. 10001111 **f.** 10101111 **g.** 1101111 **h.** 11100010

4 **a.** bit **b.** nibble **c.** byte **d.** nibble

e. bit **f.** byte

Exercise D

1 **a.** 0+ 2+4+8 =14 **b.** 1+2+0+0+16 =19 **c.** 0+0+4+8=12

d. 0+0+4+0+16=20 **e.** 1+0+0+8+0+32 = 41 **f.** 1+2+0+0+16+32 = 51

g. 1+2+0+8+16+0+64=91 **h.** 0+0+0+0+0+0+64=64 **i.** 0+0+4+0+0+32+64=100

j. 1+1+0+0+0+0+64+128=195

2 **a.** False **b.** True **c.** True **d.** True **e.** False **f.** True **g.** True **h.** True **i.** True **j.** True

3 **a.** 13 **b.** 79 **c.** 39 **d.** 583 **e.** 8 **f.** 76 **g.** 0 **h.** 77

4 **a.** 4 **b.** 12 **c.** 18 **d.** 4 **e.** 39 **f.** 52 **g.** 4 **h.** 11

5 1001 10011 11101 100111

a. 9 19 29 39

b. 110001 and 49

Exercise E

1 **a.** 1010 **b.** 1111 **c.** 10100 **d.** 11100 **e.** 11100110 **f.** 10011110

g. 10010001 **h.** 11011001 **I.** 11010111 **j.** 10101111 **k.** 11011101 **l.** 11111111

2

Hexadecimal	B3	16	D6	25	3F

Binary	10110	11010110	100101	111111	10110011

3 **a.** False **b.** False **c .** True

d. True **e.** False **f.** False

g. False **h.** True **i.** True

j. False **k.** False **l.** False

Exercise F

1 **a.** 2D b. 55 c. B2 d. 6A e. BE f. 35 g. EE h. D5 i. 74 j. 2A k. 3A l. 77

2 **a.** True **b.** False **c.** True **d.** True **e.** True **f.** True

g. True **h.** True **i.** False **j.** False **k.** False **l.** False

3 1000000 10101010 ~~11000011~~ ~~10111101~~ ~~11111111~~

Exercise G

1 **a**. 10 **b.** 15 **c.** 20 **d.** 28 **e.** 230 **f.** 158

g. 145 **h.** 217 **i.** 215 **j.** 175 **k.** 221 **i.** 255

2

4 x 16 + 15	9D
9 x 16 + 4	D4
9 x16 +13	4F
13 x 16 +4	D9
13 x 16+9	94

3 **a.** False b. False c. True d. True e . True

f. True g. Falseh. False i. False j. True

4 **a.** 26 **b.** 82 **c.** 69 **d.** 12 **e.** 258 **f .** 304 **g.** 190 **h.** 119

5 **a.** 25_{10} $1F_{16}$ 99_{16} AB_{16} 300_{10}

b. $4B_{16}$ l 80_{10} $9F_{16}$ $C3_{16}$ 200_{10}

Exercise H

1 **a.** 9 **b.** F **c.** 28 **d.** 5A **e.** 7A **f.** 87

g. 9D **h.** A4 **i.** C7 **j.** D9 **k.** C8 **i.** F0

2 **a.** True **b.** False **c.** False **d.** True

e. True **f.** True **g.** True **h.** False

i. False **j.** False

3 **a.** 1E **b.** 6C **c .** 27 **d.** 15 **e.** D6 **f .** ED **g.** CE **h.** 67

4 **a.** 13 23 33 43

b. 35 3F

Exercise I

1 **a.** 100 **b.** 1001 **c.** 101 **d.** 1000 **e.** 111 **f.** 1010

2 **a.** 1110 **b.** 1011 **c.** 1100 **d.** 10010 **e.** 1001010 **f.** 1001011

g. 10110111 **h.** 11110100 **i.** 11000011

3

1100 + 1101=25	1010 + 100=14	1000000 + 100=68	11001 + 1001011=100
1000 + 100011=43	10100 + 101=25	110010+ 110010=100	11001 + 10100=45
10 + 101=7	100000 + 100000=64	11 + 100=7	1 + 1101=14

4

	Jade	**Cameron**
Round 1	100011=35	100101=37 ✔
Round 2	111001=57✔	100010=34
Round 3	1011011=91✔	1011001=89
Round 4	1001111=79	1011110=94✔
Round 5	10010100=148	10110100=180✔

Cameron wins by 3 points to 2 points.

Exercise J

1 **a.** 1111 **b.** 11000 **c.** 1000001 **d.**1000110 **e.** 10000111

2 **a.** 100 + 101 +1001< 1000 + 10000 +11

b. 110011 + 1001 010 + 1011101 > 101010 + 1011011 + 110001

3 **a.** 1001 **b.** 10001 **c.** 100111 **d.** 1001011 **e.** 1011101 **f.** 1111001

g. 1101011 **h.** 11001011

Exercise K

1 Work out the answer to each binary subtraction. Give your answer in binary.

a. 10 **b.** 11 **c.** 11 **d.** 2 **e.** 1001

f. 10000 **g.** 1000011 **h.** 10011 **i.** 1 **j.** 1000001

k. 101100 **l.** 10100001

2

	Tom	**Ravinder**
Round 1	11=3✔	1=1
Round 2	11011=27✔	1000=8
Round 3	111=7	1101=13✔
Round 4	1011=11	10001=17✔
Round 5	1100=12	10101=21✔

Ravinder won by three points to 2

Exercise L

1 **a.** 1010 **b.** 1110 **c.** 10110 **d.** 111000

e. 11110 **f.** 1000000 **g.** 111010 **h.** 1110100

i. 111100 **j.** 1001010 **k.** 11101000 **l.** 1110110

2 **a.** 21 x 4=84=1010100 **b.** 29 x 4=116=1110100

c. 54 x 4=216=11011000 **d.** 13 x 8=104=1101000

e. 25 x 4=100=1100100 **f.** 27 x 4=108=1101100

g. 22 x 8=176=10110000 **h.** 107 x 2=214=11010110

i. 59 x 4=236=11101100 **j.** 11 x 8=88=1011000

k. 45 x 4=180=10110100 **l.** 15 x 8=120=1111000

Exercise M

1 **a.** 11 **b.** 10 **c.** 101 **d.** 11 **e.** 110 **f.** 100

g. 1110 **h.** 111 **i.** 1111 **j.** 10010 **k.** 1101 **l.** 11110

2 **a.** 20 / 4=5=101 **b.** 24 / 4 = 6 = 110 **c.** 54 / 4=13=1101 **d.** 55 / 4=13=1101

e. 29 / 4=7=111 **f.** 53 / 4=13=1101 **g.** 88 / 8=11=1011 **h.** 106 / 4=26=11010

i . 59 / 8=7=111 **j.** 83 / 8=10=1010 **k.** 180 / 8=22=10110 **l.** 220 / 8=27=11011

Compression

Exercise A

1 a 1 b 3 c 52 d 1 – difference of 30 e 195 f No, he was set no homework 21 times

2 a The smallest result with 2 dice is 2. b Kayleigh c 3

d Kayleigh (13 times compared to 7 times) e Kayleigh (50 times compared to 48 times)

3 a

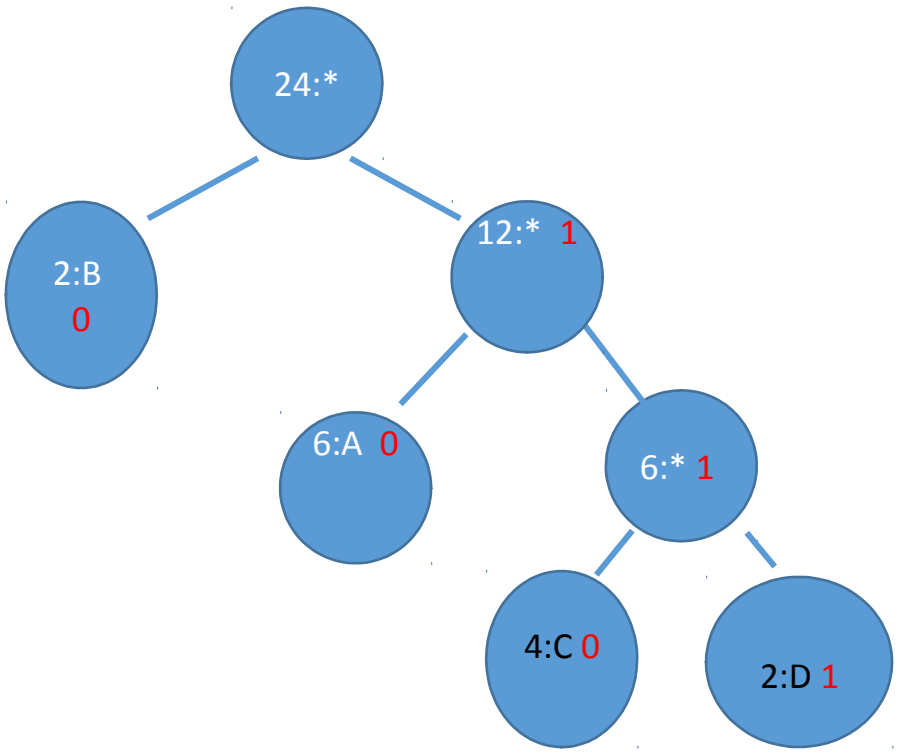
Candidate	Frequency
E	10
F	8
G	1
H	17
Total	36

b 36 c H – 17 votes d E because they got the second most votes.

Huffman Tree

Exercise B

1

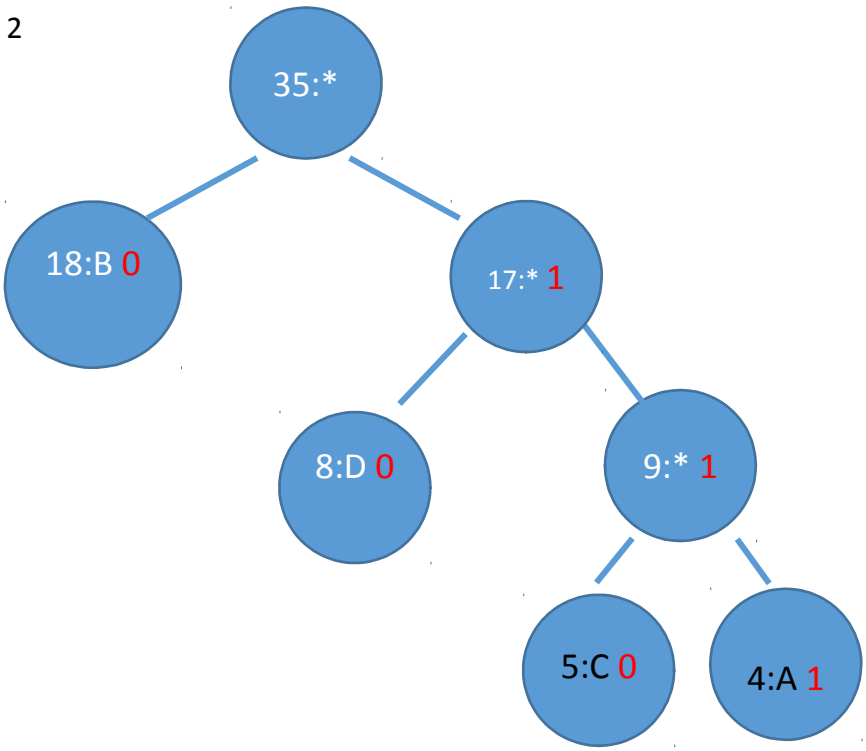


Without compression 24*8 = 192 bits

With compression 2*1 + 6*2 +6*2 + 4*3 + 2*3 = 32 bits

Saving = 192-32 = 160 bits

2

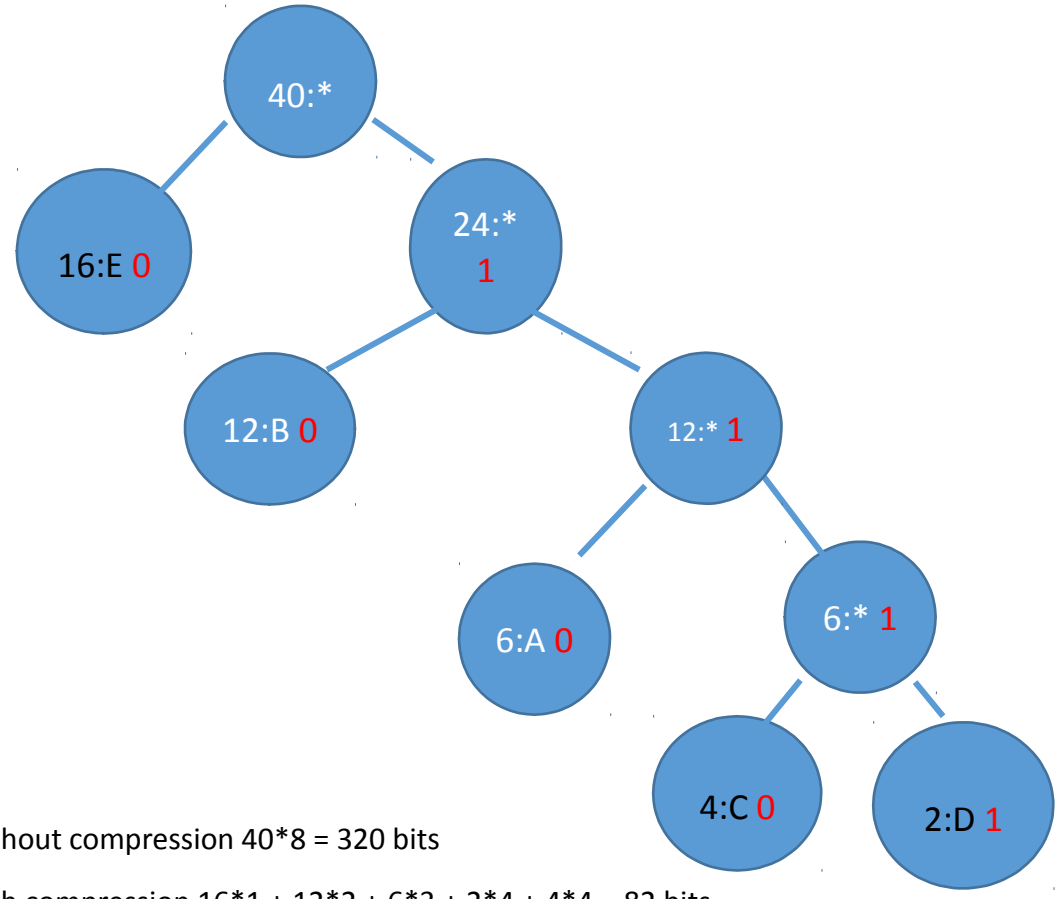


Without compression 35*8 = 280 bits

With compression 18*1 + 8*2 + 9*2 + 5*3 + 4*3 = 79 bits

Saving = 280-79 = 201 bits

3

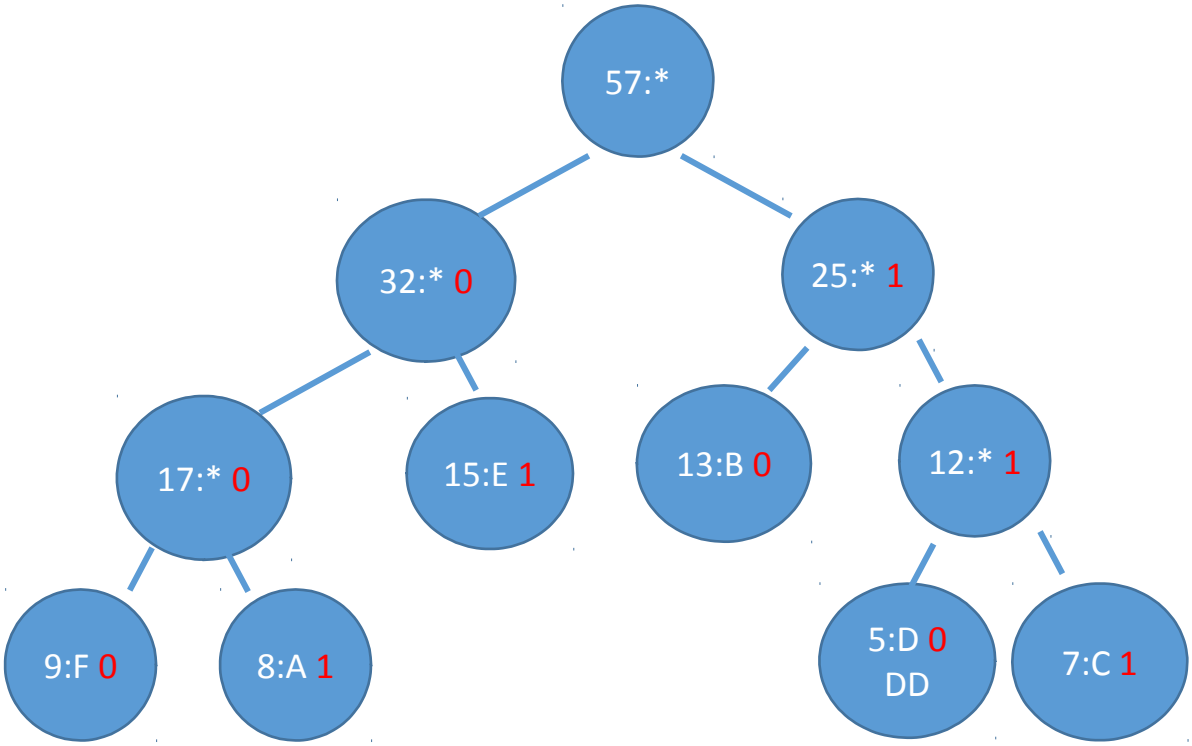


Without compression 40*8 = 320 bits

With compression 16*1 + 12*2 + 6*3 + 2*4 + 4*4 = 82 bits

Saving = 320-82 = 238 bits

4



Without compression 57*8 = 456 bits

With compression 15*2 + 9*3 + 8*3 + 13*2 + 5*3 + 7*3 = 143 bits

Saving = 456-143 = 313 bits

Run Length Encoding

Exercise C

1. 3A2b8H2Z = 8 bytes **2.** 41 40 71 80 31 = 10 bytes **3.**7L9k6K5S7A6D = 12 bytes

4. 4a4A4G7f9H5Z7A1a = 16 bytes **5.** 31 20 41 10 51 70 11 20 31 10 = 20 bytes

Algorithms

Exercise A

1 **a.** 58 **b.** 57 **c.** 58 **d.** 123 **e.** 89 **f.** 85

2 **a.** 41 **b.** 31 **c.** 66 **d.** 126 **e.** 156 **f.** 216

Exercise B

1 **a.** dog older **b.** dog older **c.** dog older **d.** dog older **e.** dog older **f.** dog not older

2 **a**. 22 **b.** 8 **c.** 128 **d.** 112 **e.** 7 **f.** 23 **g.** 25 **h.** 16 **i.** 28

Nested Selection

Exercise C

1 **a.** Free **b.** Free **c.** Shipping Cost is £14.99 **d.** Shipping Cost is £4.99

e. Free **f.** Free **g.** Shipping Cost is £9.99 **h.** Free

2 **a.** A **b.** B+ **c.** B- **d.** C- **e.** B+ **f.** C- **g.** C+ **h.** You are required to retake the test

i. A- **j.** B- **k.** A+ l. A*

Definite Iteration

Exercise D

1 **a.**

Variable Value	**Output**
count = 0	8
count = 1	12
count = 2	20
count = 3	36
count = 4	68
count = 5	132
count = 6	260
count = 7	516

b. 16 iterations

c.

Variable Value	**Output**
count = 0	16

count = 1	28
count = 2	52
count = 3	100
count = 4	196
count = 5	388
count = 6	772
count = 7	1540

2 **a.**

Variable Value	**Output**
count = 3	True
count = 4	True
count = 5	False
count = 6	False
count = 7	False
count = 8	False
count = 9	False
count = 10	False

b. 11 Iterations

c.

Variable Value	**Output**
count = 3	True
count = 4	False
count = 5	False
count = 6	False
count = 7	False
count = 8	False
count = 9	False
count = 10	False

Indefinite Iteration

Exercise E

1 a.

Variable Value	**Output**

Total = 1	1
Total = 2	2
Total = 3	3
Total = 4	4
Total = 5	5
Total = 6	6
Total = 7	7
Total = 8	8

b. 19

c. 10

2 **a.** 4 **b.** 3 **c.** 4 **d.** 4 **e.** 3 **f.** 6

Exercise F

1 **a**. 9 b. 36 c. 27 d. 45 e. 93 f. 129 g. 117 h. 81 i. 141

2 **a.** FALSE **b.** FALSE **c.** FALSE **d.** TRUE **e.** TRUE **f.** TRUE

g. TRUE **h.** TRUE **i.** TRUE

Common Algorithms

Exercise A

1 2 repetitions: 50, 30 (found)

2 2 repetitions: 55, 72 (found)

3 Order: 11, 19, 23, 26, 29, 30, 40, 44, 48, 51: 2 repetitions: 29, 19

Exercise B

1 [3,5,2,7] [3,2,5,7] [2,3,5,7] [2,3,5,7]

2 [2,3,5,4,7] [2,3,4,5,7] [2,3,4,5,7]

3 [3,9,1,8,7,11] [3,1,8,7,9,11] [1,3,7,8,9,11] [1,3,7,8,9,11]

4 After the 1st pass: [2, 8, 7, 3, 1, 2, 8]

After the 2nd pass: [2, 7, 3, 1, 2, 8, 8]

After the 3rd pass: [2, 3, 1, 2, 7, 8, 8]

After the 4th pass: [2, 1, 2, 3, 7, 8, 8]

After the 5th pass: [1, 2, 2, 3, 7, 8, 8]

After the 6th pass: [1, 2, 2, 3, 7, 8, 8]

5 After the 1st pass: [1, 5, 7, 6, 1, 7, 8]

After the 2nd pass: [1, 5, 6, 1, 7, 7, 8]

After the 3rd pass: [1, 5, 1, 6, 7, 7, 8]

After the 4th pass: [1, 1, 5, 6, 7, 7, 8]

After the 5th pass: [1, 1, 5, 6, 7, 7, 8]

6 After the 1st pass: [6, 2, 1, 1, 8, 4, 9]

After the 2nd pass: [2, 1, 1, 6, 4, 8, 9]

After the 3rd pass: [1, 1, 2, 4, 6, 8, 9]

After the 4th pass: [1, 1, 2, 4, 6, 8, 9]

Exercise C

1

	number	count	OUTPUT
1	10		
2		1	
3	16		
4	12		
5			12
6			Keep Looping
2		2	
3	18		
4	14		
5			14
6			Keep Looping
8			Finished Looping

18

2

	x	count	answer	OUTPUT
1	6			
2		1		
3			6	
4				6
2		2		
3			12	
4				12
2		3		
3			18	
4				18
6				Finished

3

	number	count	OUTPUT
1	64		
2		1	
4	32		
5		2	
4	16		
5	8	3	
4	4		
5		4	
3			1
5		5	
6			Smaller
3			2
5		9	
6			Smaller
3			3
5		27	
6			Smaller
3			4
5		81	
6			Smaller
3			5
8			Bigger
3			6
8			Bigger
10			Finished

4

	x	total	count	OUTPUT
1	60			
2		1		
3		4		
4	4		1	
5		3		
6		5		Smaller
7			Finished!	

Input		Output (Q)
A	B	
1	1	1
1	0	1
0	1	1
0	0	0

Logic Circuits

Exercise A

1 **a.** 0 **b.** 1 **c.** 0 **d.** 1 **e.** 0 **f.** 1 **g.** 1 **h.** 0
2 **a.** 1 **b.** 0 **c.** 1 **d.** 1

Exercise B

Input	Output (Q)
A	
1	0
0	1

1 a

Input		Output (Q)
A	B	
1	1	1
0	1	0
1	0	0
0	0	0

b

c

2

Input			Output (Q)
A	B	C	
1	1	1	0
0	1	1	0
1	0	1	0
0	0	0	1

3

Input			Output (Q)
A	B	C	
1	1	0	0
0	1	1	1
1	0	0	0
0	0	1	0

4

Input				Output (Q)
A	B	C	D	
1	1	1	1	1
0	0	0	0	0
1	0	0	0	0
0	0	1	0	1
1	1	0	1	1
0	1	1	0	1
1	0	1	0	1
0	1	0	0	0

5

Input				Output (Q)
A	B	C	D	
1	1	1	1	1
1	0	1	1	1
0	1	1	1	1
0	0	1	0	0
1	1	0	1	0
1	0	0	1	0
0	1	0	1	0
0	0	0	0	0

6

Input					Output (Q)
A	B	C	D	E	
1	1	1	1	0	0
1	0	0	1	0	0
0	1	0	1	0	0
0	0	0	1	0	0
1	1	1	0	1	1
1	0	0	0	1	0
0	1	0	0	1	0
0	0	0	0	1	0