



GCSE Computer Science Booster Pack (Answers)

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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 $13 \neq 31 - 17$
 d. True e. True f. False $23 - 30 \neq -6$
 g. False $-7 \neq -3 - 7$ h. True i. True
- 5 a. $10 == 7 + 3$ b. $16 == 48 / 3$ c. $24 == 6 * 4$
 d. $18 \neq 34 - 25$ e. $-11 \neq 8 - 14$ f. $-10 == 33 - 43$
 g. $-9 \neq 4 - 14$ h. $13 == 52 / 4$ i. $22 + 26 == 12 * 4$
- 6 a. True b. True c. True
 d. True e. False $-5 \geq 8 - 14$ f. True
 g. True h. False $15 \leq 34 / 2$ i. True
- 7 a. $19 \geq 11 + 7$ b. $20 - 4 \leq 12 + 6$ c. $13 \geq 14 - 17$
 d. $7 \geq 32 - 25$ e. $-5 \leq 12 - 14$ f. $-10 \leq 46 - 47$
 g. $-9 \geq -3 - 9$ h. $16 \geq 80 / 5$ i. $48 \geq 12 * 3$

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. $60/2=30r0$ 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 two times as large as 10.
 - c. True
 - d. False. 10 is 8 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
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Binary	10110	11010110	100101	111111	10110011
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- 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

$4 \times 16 + 15$	9D
$9 \times 16 + 4$	D4
$9 \times 16 + 13$	4F
$13 \times 16 + 4$	D9
$13 \times 16 + 9$	94

- 3** **a.** False **b.** False **c.** True **d.** True **e.** True
 f. True **g.** False **h.** 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. $4B_{16}$ | 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	$100011 = 35$	$100101 = 37 \checkmark$
Round 2	$111001 = 57 \checkmark$	$100010 = 34$
Round 3	$1011011 = 91 \checkmark$	$1011001 = 89$
Round 4	$1001111 = 79$	$1011110 = 94 \checkmark$
Round 5	$10010100 = 148$	$10110100 = 180 \checkmark$

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. $110011 + 1001010 + 1011101 > 101010 + 1011011 + 110001$
- 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. $21 \times 4 = 84 = 1010100$ | b. $29 \times 4 = 116 = 1110100$ |
| c. $54 \times 4 = 216 = 11011000$ | d. $13 \times 8 = 104 = 1101000$ |
| e. $25 \times 4 = 100 = 1100100$ | f. $27 \times 4 = 108 = 1101100$ |
| g. $22 \times 8 = 176 = 10110000$ | h. $107 \times 2 = 214 = 11010110$ |
| i. $59 \times 4 = 236 = 11101100$ | j. $11 \times 8 = 88 = 1011000$ |
| k. $45 \times 4 = 180 = 10110100$ | l. $15 \times 8 = 120 = 1111000$ |

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

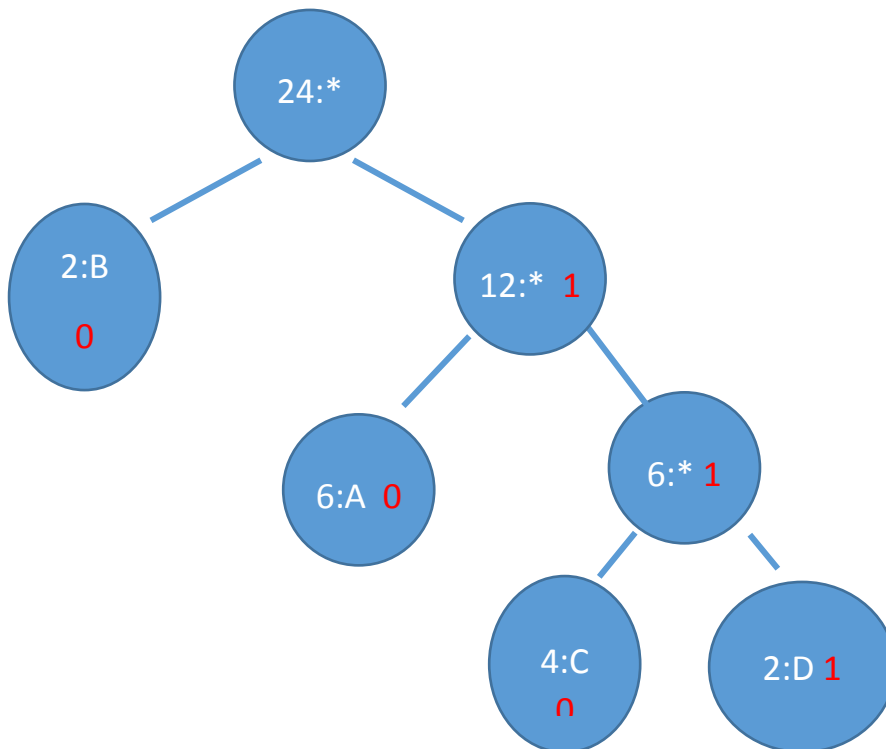
Candidate	Frequency
E	10
F	8
G	1
H	17
Total	36

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

Huffman Tree

Exercise B

1

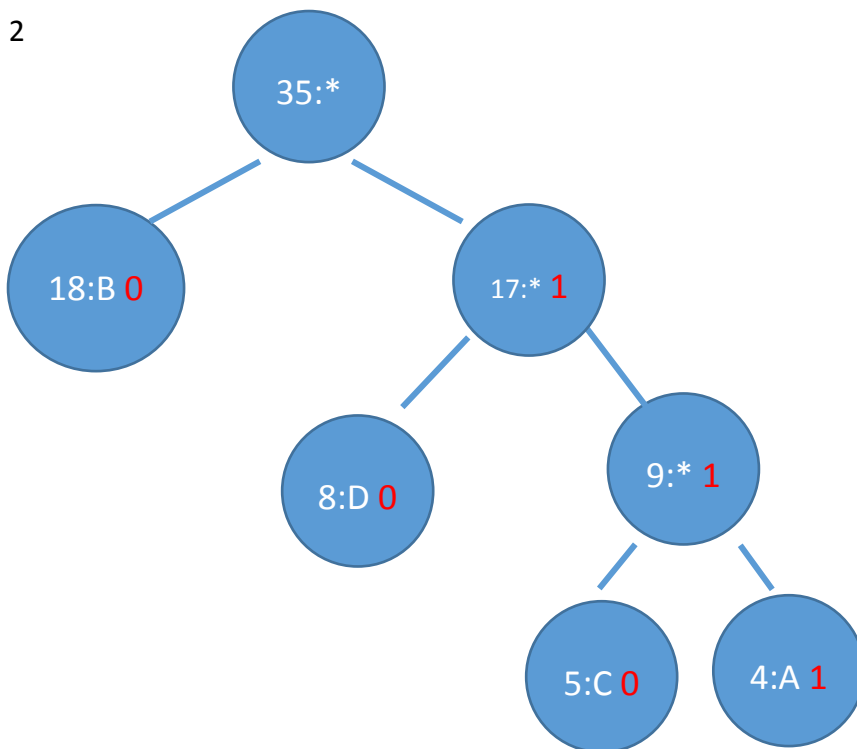


Without compression $24 \times 8 = 192$ bits

With compression $2 \times 1 + 6 \times 2 + 6 \times 2 + 4 \times 3 + 2 \times 3 = 32$ bits

Saving = $192 - 32 = 160$ bits

2

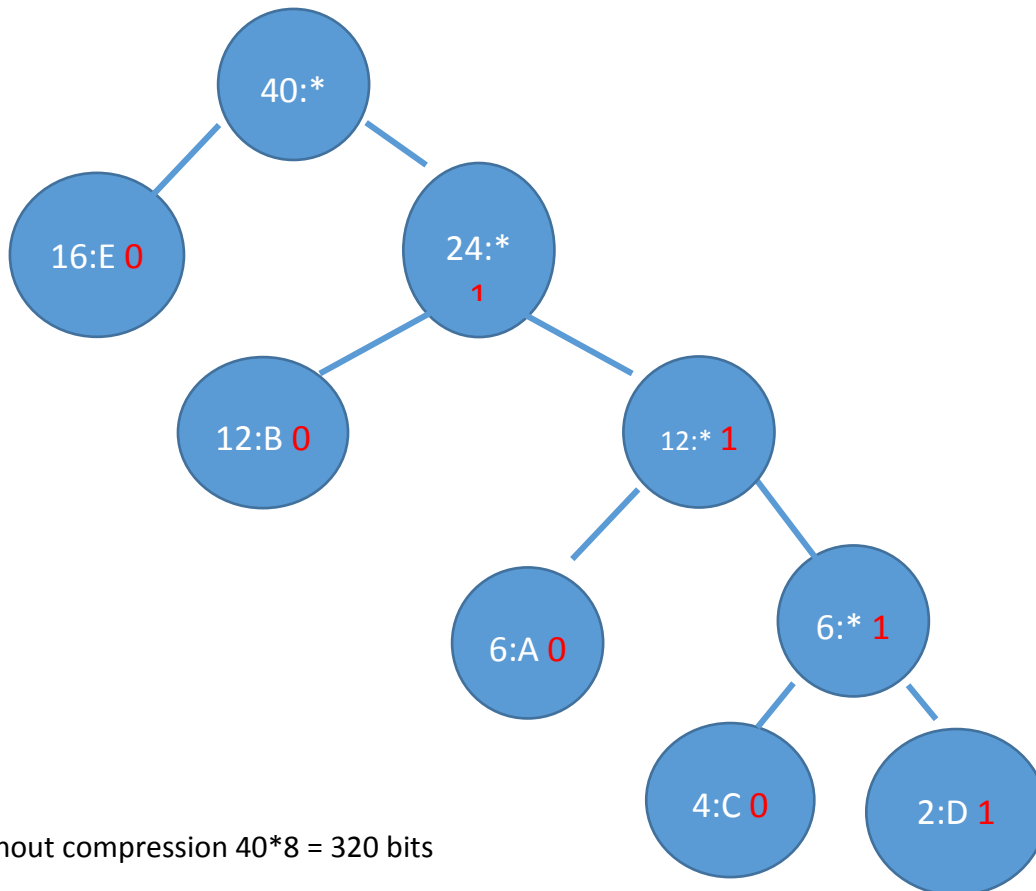


Without compression $35 \times 8 = 280$ bits

With compression $18 \times 1 + 8 \times 2 + 9 \times 2 + 5 \times 3 + 4 \times 3 = 79$ bits

Saving = $280 - 79 = 201$ bits

3

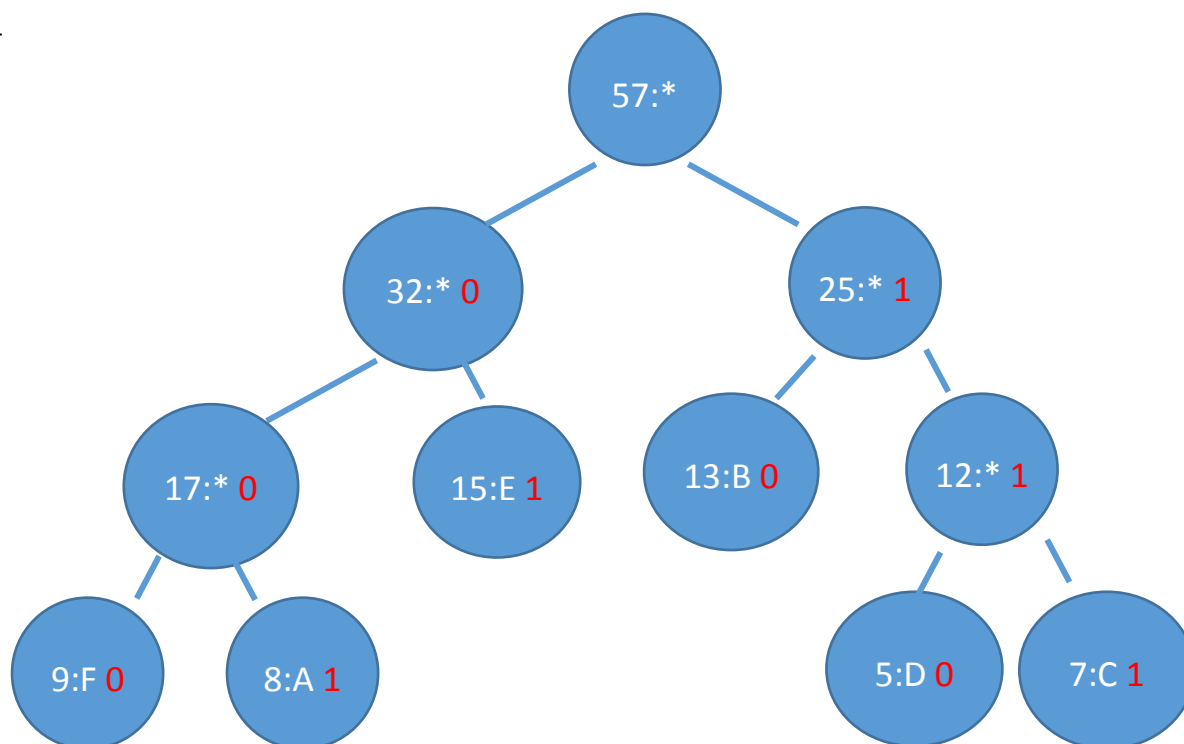


Without compression $40 \times 8 = 320$ bits

With compression $16 \times 1 + 12 \times 2 + 6 \times 3 + 2 \times 4 + 4 \times 4 = 82$ bits

Saving = $320 - 82 = 238$ bits

4



Without compression $57 \times 8 = 456$ bits

With compression $15 \times 2 + 9 \times 3 + 8 \times 3 + 13 \times 2 + 5 \times 3 + 7 \times 3 = 143$ 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

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		3	
4	8		
5		4	
4	4		
5		5	
7			Finished!

4

	x	total	count	OUTPUT
1	60			
2		1		
3			1	
5		3		
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

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

1 a

Input	Output (Q)
A	
1	0
0	1

b

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

c

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

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

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

6