CSPB 2400 - Park - Computer Systems

Started on	Wednesday, 7 February 2024, 12:26 PM
State	Finished
Completed on	Wednesday, 7 February 2024, 1:39 PM
Time taken	1 hour 12 mins
Marks	100.00/100.00
Grade	**10.00** out of 10.00 (**100**%)

Question **1**

Correct

Mark 2.00 out of 2.00

Fill in the following truth table for XOR.

X	Y	X ^ Y
0	0	0 ✔
0	1	1 ✔
1	0	1 ✔
1	1	0 ✔

Question **2**

Correct

Mark 4.00 out of 4.00

Evaluate the bitwise OR of

1110010010_2
1110010100_2
assuming a 10-bit word. Enter the value as a binary value.

1110010110

Your last answer was interpreted as follows: 1110010110

Doing a bit-wise OR of 1110010010_2 and 1110010100_2 in a 10-bit word binary yields 1110010110_2.

You entered $\mathrm{ans}_{00000000012}$.

Correct answer, well done.

A correct answer is 1110010110, which can be typed in as follows: `1110010110`

Question **3**

Correct

Mark 4.00 out of 4.00

Evaluate the bitwise OR of

1010110000_2
1111001011_2
assuming a 10-bit word. Enter the value as a binary value.

1111111011

Your last answer was interpreted as follows: 1111111011

Doing a bit-wise OR of 1010110000_2 and 1111001011_2 in a 10-bit word binary yields 1111111011_2.

You entered $\mathrm{ans}_{00000000012}$.

Correct answer, well done.

A correct answer is 1111111011, which can be typed in as follows: `1111111011`

Question **4**

Correct

Mark 4.00 out of 4.00

Evaluate the left shift of the binary number 00100100_2 << 4 assuming a 8-bit word. Enter the value as a binary value.

01000000

Your last answer was interpreted as follows: 1000000

Shifting 00100100_2 left by 4 bits in a 8-bit word binary yields 01000000_2. You entered $\mathrm{ans}_{000000012}$.

Correct answer, well done.

A correct answer is 1000000, which can be typed in as follows: `1000000`

Question **5**

Correct

Mark 4.00 out of 4.00

Evaluate the arithmetic right shift of the binary number 111100_2 >> 1 assuming a 6-bit word. Enter the value as a binary value.

111110

Your last answer was interpreted as follows: 111110

Arithmetically shifting 111100_2 right by 1 bits in a 6-bit word binary yields 111110_2. You entered $\mathrm{ans}_{00000012}$.

Correct answer, well done.

A correct answer is 111110, which can be typed in as follows: `111110`

Question **6**

Correct

Mark 4.00 out of 4.00

Evaluate the logical right shift of the binary number 000011_2 >> 1 assuming a 6-bit word. Enter the value as a binary value.

000001

Your last answer was interpreted as follows: 1

Logically shifting 000011_2 right by 1 bits in a 6-bit word binary yields 000001_2. You entered $\mathrm{ans}_{0000012}$.

Correct answer, well done.

A correct answer is 1, which can be typed in as follows: `1`

Question **7**

Correct

Mark 4.00 out of 4.00

Mask the first value using the second.:

value = 0x	3	6	B	2	A	C	B	C
mask = 0x	F	8	0	0	0	0	0	0
0x36b2acbc & 0xf8000000 = 0x	3 ✔	0 ✔	0 ✔	0 ✔	0 ✔	0 ✔	0 ✔	0 ✔

Question **8**

Correct

Mark 2.00 out of 2.00

Convert the hexidecimal value $0x195_{16}$ to binary assuming a 9-bit word. Enter the value as a binary value.

110010101

Your last answer was interpreted as follows: 110010101

Converting $0x195_{16}$ in a 9-bit word to binary yields 110010101_2.

Correct answer, well done.

A correct answer is 110010101, which can be typed in as follows: `110010101`

Question **9**

Correct

Mark 4.00 out of 4.00

Convert the 3-bit signed binary value 010 to a base 10 (decimal) number. You may enter an expression if you like.

2

Your last answer was interpreted as follows: 2

Converting the signed binary 010 to decimal yields 2.

Because the sign-bit is 0, it has value 0; the final value is $0 + 2 = 2$.

Correct answer, well done.

A correct answer is 2, which can be typed in as follows: 2

Question **10**

Correct

Mark 4.00 out of 4.00

Convert the 6-bit unsigned value 11001_2 to a base 10 (decimal) number. You may enter an expression if you wish.

25

Your last answer was interpreted as follows: 25

Converting 011001 to decimal yields 25.

Correct answer, well done.

A correct answer is 25, which can be typed in as follows: 25

Question **11**

Correct

Mark 4.00 out of 4.00

Convert the 5-bit signed binary value 00000 to a base 10 (decimal) number. You may enter an expression if you like.

0

Your last answer was interpreted as follows: 0

Converting the signed binary 00000 to decimal yields 0.

Because the sign-bit is 0, it has value 0; the final value is $0 + 0 = 0$.

Correct answer, well done.

A correct answer is 0, which can be typed in as follows: `0`

Question **12**

Correct

Mark 4.00 out of 4.00

Convert the number 21_{10} to a 6-bit signed binary value.

010101

Your last answer was interpreted as follows: 10101

Converting the decimal value 21_{10} to signed binary yields 010101.

Because the sign-bit is 0, it has value 0; the final value is $0 + 21 = 21$.

Correct answer, well done.

A correct answer is 10101, which can be typed in as follows: `10101`

Question **13**

Correct

Mark 4.00 out of 4.00

Convert the decimal number 28_{10} to an unsigned 6-bit binary value.

011100

Your last answer was interpreted as follows: 11100

Converting 28 to binary yields 011100.

Correct answer, well done.

A correct answer is 11100, which can be typed in as follows: `11100`

Question **14**

Correct

Mark 6.00 out of 6.00

Assume you have a 7-bit signed two's complement numeric representation.

What is the largest positive value you can represent (Tmax).

You should enter a base-10 number: 63

Your last answer was interpreted as follows: 63

What is the most negative value you can represent (Tmin)

You should enter a base-10 number: -64

Your last answer was interpreted as follows: -64

Correct answer, well done.
Correct answer, well done.

Correct answer, well done.

For a 7-bit signed representation, the largest positive number you can represent is $2^{7-1} - 1 = 63$ and the largest negative number you can represent is $-2^{7-1} = -64$.

A correct answer is 63, which can be typed in as follows: `63`

A correct answer is -64, which can be typed in as follows: `-64`

Question **15**

Correct

Mark 4.00 out of 4.00

Suppose we truncate a 8-bit integer 00010110_2 with signed representation 22 and unsigned representation 22 to a 5-bit integer 10110_2.

What is the decimal value of the truncated value when represented as unsigned? 22

Your last answer was interpreted as follows: 22

Correct answer, well done.
Correct - the truncated value is simply treated as an unsigned number.

What is the decimal value of the truncated value when represented as signed? -10

Your last answer was interpreted as follows: -10

Correct answer, well done.
Correct - the truncated binary value is interpreted as a negative number.

A correct answer is 22, which can be typed in as follows: `22`

A correct answer is -10, which can be typed in as follows: `-10`

Question **16**

Correct

Mark 6.00 out of 6.00

Compute the sum of these two signed 7-bit numbers as a 7-bit result. We'll show you the numbers in decimal and binary, but you should enter your answer in **binary**.

$$\begin{array}{rrr} & 25 & 11001_2 \\ + & 24 & 11000_2 \\ \hline \end{array}$$

You may enter an expression if you like.

0110001

Your last answer was interpreted as follows: 110001

Correct answer, well done.

The correct response is 110001 or 49.

Signed and unsigned addition perform the same bit-level operations.

If we solved this problem as an unsigned 7 bits problem, the answer would be $25 + 24 \bmod 128$, or 49 (110001) when interpreted as unsigned values. This same bitstring would be interpreted as $49 + 0$ or 49 in two's complement signed representation.

A correct answer is 110001, which can be typed in as follows: `110001`

Question **17**

Correct

Mark 6.00 out of 6.00

Compute the sum of these two signed 4-bit numbers as a 4-bit result. We'll show you the numbers in decimal and binary, but you should enter your answer in **binary**.

$$\begin{array}{rrr} & 6 & 0110_2 \\ + & 7 & 0111_2 \\ \hline \end{array}$$

You may enter an expression if you like.

1101

Your last answer was interpreted as follows: 1101

Correct answer, well done.

The correct response is 1101 in binary or -3 in decimal.

Signed and unsigned addition perform the same bit-level operations.

If we solved this problem as an unsigned 4 bits problem, the answer would be $6 + 7 \bmod 16$, or 13 (1101) when interpreted as unsigned values. This same bitstring would be interpreted as $5 + -8$ or -3 in two's complement signed representation.

A correct answer is 1101, which can be typed in as follows: `1101`

Question **18**

Correct

Mark 6.00 out of 6.00

Compute the sum of these two signed 7-bit numbers as a 7-bit result. We'll show you the numbers in decimal and binary, but you should enter your answer in decimal.

$$\begin{array}{rrr} & -57 & 1000111_2 \\ + & -62 & 1000010_2 \\ \hline \end{array}$$

You may enter an expression if you like.

9

Your last answer was interpreted as follows: 9

Correct answer, well done.

The correct response is 9.

Signed and unsigned addition perform the same bit-level operations.

If we solved this problem as an unsigned 7 bits problem, the answer would be $71 + 66$ mod 128, or 9 (0001001) when interpreted as unsigned values. This same bitstring would be interpreted as $9 + 0$ or 9 in two's complement signed representation.

A correct answer is 9, which can be typed in as follows: 9

Question **19**

Correct

Mark 4.00 out of 4.00

Convert the binary fractional number 110.01_2 to a decimal representation. You can use fractions or floating point values, but your answer must be precise. You can use expressions if that's useful.

6.25

Your last answer was interpreted as follows: 6.25

Correct answer, well done.
As described in Chapter 2, the binary fractional value $b_m b_{m-1} \ldots b_1 b_0 . b_{-1} b_{-2} \ldots b_{-n}$ represents a fractional value using a place-digit representation where the value of *e.g.* the i^{th} digit is $2^i * b_i$.

This means that the value of the bits to the left of the fraction is $\sum_{i=0}^{m} 2^i * b_i$. In this problem m=3 and the value of the non-fractional part is $110_2 = 6_{10}$.

Similarly, the value of the bits to the right of the fraction is $\sum_{i=0}^{n} 2^{-i} * b_i = \sum_{i=0}^{n} \frac{b_i}{2^i}$. In this problem n=$2$ and the value of the non-fractional part is $.01_2 = \frac{01_2}{2^2} = \frac{1}{4} = \frac{1}{4}$.

Thus, the value of the binary fractional number is $6 + \frac{1}{4} = \frac{25}{4} = 6.25$.

A correct answer is $\frac{25}{4}$, which can be typed in as follows: 25/4

Question **20**

Correct

Mark 6.00 out of 6.00

Consider a 8-bit floating-point representation based on the IEEE floating-point format, with one sign bit, 3 exponent bits and 4 fraction bits. The exponent bias follows the IEEE standard.

Interpret the bitstring $0\_100\_0011_2$ using this 8-bit floating-point representation and fill in the table below.

You must express your results precisely (e.g. using rationals (M/N) and exponents (M^N), rather than approximate decimal fractions such as 0.ABCD). You may use expressions if it's useful.

Field	Mean	Value
e	The value represented by considering the exponent field to be an unsigned integer (as a decimal value)	4 Your last answer was interpreted as follows: 4
E	The value of the exponent after biasing (as a decimal value)	1 Your last answer was interpreted as follows: 1
2^E	The numeric weight of the exponent (as a decimal value)	2 Your last answer was interpreted as follows: 2
f	The value of the fraction (as a fraction such as 3/4 or the exact floating point number)	3/16 Your last answer was interpreted as follows: $\frac{3}{16}$
M	The value of the significand (as a fraction such such as 7/4 or the exact floating point number)	19/16 Your last answer was interpreted as follows: $\frac{19}{16}$
$s*2^E * M$	The value of the number in decimal. The 's' is equal to +1 if the number is positive and -1 if it is negative.	1*2^1*(19/16) Your last answer was interpreted as follows: $1 \cdot 2^1 \cdot \left(\frac{19}{16}\right)$

Correct answer, well done.
Correct answer, well done.

Correct answer, well done.

Correct answer, well done.

Correct answer, well done.

Correct answer, well done.

Correct answer, well done.

The value of e is 4. Since the bias is 3, the value of E is 4-3 = 1 and the value of the exponent is $2^1 = 2$.

The value of f is $\frac{3}{16} = \frac{3}{16}$. Because this is a normalized number, there is an implicit leading '1', meaning that M = $\frac{19}{16}$.

When all of the parts are combined, s*2^E * M = $\frac{19}{8}$ or 2.375.

A correct answer is 4, which can be typed in as follows: 4

A correct answer is 1, which can be typed in as follows: 1

A correct answer is 2, which can be typed in as follows: 2

A correct answer is $\frac{3}{16}$, which can be typed in as follows: 3/16

A correct answer is $\frac{19}{16}$, which can be typed in as follows: 19/16

A correct answer is $\frac{19}{8}$, which can be typed in as follows: 19/8

Question **21**

Correct

Mark 7.00 out of 7.00

Consider a 8-bit floating-point representation based on the IEEE floating-point format, with one sign bit, 3 exponent bits and 4 fraction bits. The exponent bias follows the IEEE standard.

Convert the decimal floating point number 0.140625 (or $\frac{9}{64}$) to the appropriate IEEE representation. Enter the binary representation of each field (sign, exp, fraction)

s	e	f
0 Your last answer was interpreted as follows: 0	000 Your last answer was interpreted as follows: 0	1001 Your last answer was interpreted as follows: 1001

Correct answer, well done.
Correct answer, well done.

Correct answer, well done.

Correct answer, well done.

The correct IEEE binary representation is the bitstring $0\_000\_1001_2$ using the 8-bit floating-point representation.

Because we have a 3-bit exponent field, the exponent E can range between $2^{-4-2} = 2^{-(2)} = \frac{1}{4}$ through $2^{4-1} = 8$.

We find that $\frac{9}{64} = \frac{9}{16} * \frac{1}{4}$, and that $|\frac{9}{16}|$ is less than 1.0. Because this is less than 1.0, this can only be represented using a denormalized number.

The value of e is 0 or 000_2 because this is a denormalized number. Double checking this, since the bias is 3 and this number is denormalized the value of E is $(0+1)$-3 = -2 and the value of the exponent is $2^{-2} = \frac{1}{4}$.

The value of M is $\frac{9}{16} = \frac{9}{16}$. Because this is a denormalized number, there is no implicit leading '1', meaning that f = 1001_2.

When all of the parts are combined, s*2^E * M = $\frac{9}{64}$ or 0.140625.

A correct answer is 0, which can be typed in as follows: `0`

A correct answer is 0, which can be typed in as follows: `0`

A correct answer is 1001, which can be typed in as follows: `1001`

Question **22**

Correct

Mark 7.00 out of 7.00

Consider a 8-bit floating-point representation based on the IEEE floating-point format, with one sign bit, 4 exponent bits and 3 fraction bits. The exponent bias follows the IEEE standard.

Convert the decimal floating point number 32.0 (or 32) to the appropriate IEEE representation. Enter the binary representation of each field (sign, exp, fraction)

s	e	f
0 Your last answer was interpreted as follows: 0	1100 Your last answer was interpreted as follows: 1100	000 Your last answer was interpreted as follows: 0

Correct answer, well done.
Correct answer, well done.

Correct answer, well done.

Correct answer, well done.

The correct IEEE binary representation is the bitstring $0\_1100\_000_2$ using the 8-bit floating-point representation.

Because we have a 4-bit exponent field, The bias is $2^{4-1} - 1 = 7$.

The smallest positive normalized number is $2^{1-7} = \frac{1}{64}$, which is smaller than 32. So we should choose a normalized number representation, with M = 1 + f.

We need to find s, E, and M such that $s \cdot 2^E \cdot M = 32$. $1 <= M < 2$, so we need $E = 5$ and $e = 12$.

Solving $s \cdot 2^5 \cdot (1 + f) = 32$ for f, we find $f = \frac{0}{8}$.

When all of the parts are combined, $s \cdot 2^E \cdot M = 32$ or 32.0.

A correct answer is 0, which can be typed in as follows: `0`

A correct answer is 1100, which can be typed in as follows: `1100`

A correct answer is 0, which can be typed in as follows: `0`