



Cairo University

**Cairo University**  
**Institute Of Statistical Studies And Researches**

**Department:** Computer Science

**Academic Year:** 2016-2017 **Semester:** First

**Date:** 29/11/2016 **Level:** Diploma



Course Title:	Course code:	Time:	Exam marks:	# Exam. Sheets:
Introduction To Computer Science	CS500	90 Min	25	1 Page

**Exam. Instructions : ANSWER ALL QUESTIONS**

**Question One: (6 Marks)**

Convert the decimal number  $(22.65625)_{10}$  to its equivalent numbers in the following systems:

**Hint: Perform Direct Conversion From Binary To Octal And Hexadecimal**

- (a) Binary
- (b) Octal
- (c) Hexadecimal
- (d) Base 4

**Solution:**

(a)  $(22.65625)_{10} = (10110.10101)_2$

$22 \div 2 = 11$	$0$	$0.65625 \times 2 = 1.3125$	$1$
$11 \div 2 = 5$	$1$	$0.3125 \times 2 = 0.625$	$0$
$5 \div 2 = 2$	$1$	$0.625 \times 2 = 1.25$	$1$
$2 \div 2 = 1$	$0$	$0.25 \times 2 = 0.5$	$0$
$1 \div 2 = 0$	$1$	$0.5 \times 2 = 1.0$	$1$

(b)  $(22.65625)_{10} = (010\ 110 . 101\ 010)_2 = (26.52)_8$

(c)  $(22.65625)_{10} = (0001\ 0110 . 1010\ 1000)_2 = (16.A8)_{16}$

(d)  $(22.65625)_{10} = (112.222)_4$

$22 \div 4 = 5$	$2$	$0.65625 \times 4 = 2.625$	$2$
$5 \div 2 = 2$	$1$	$0.625 \times 4 = 2.5$	$2$
$1 \div 2 = 0$	$1$	$0.5 \times 4 = 2.0$	$2$

*Or because  $4 = 2^2$ , group each two binary bits into a single digit in base 4*

$(22.65625)_{10} = (01\ 01\ 10 . 10\ 10\ 10)_2 = (122.222)_4$

**Question Two: (5 Marks)**

Find the decimal value of the binary number  $(10000)_2$  in the following notations:

- (a) Unsigned Integer
- (b) Signed-Magnitude
- (c) Signed 1's Complement
- (d) Signed 2's Complement

Best Wishes 😊  
 Dr./Ahmed Hamza



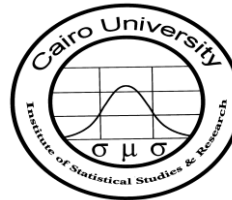
Cairo University

**Cairo University**  
**Institute Of Statistical Studies And Researches**

**Department:** Computer Science

**Academic Year:** 2016-2017 **Semester:** First

**Date:** 29/11/2016 **Level:** Diploma



Course Title:	Course code:	Time:	Exam marks:	# Exam. Sheets:
Introduction To Computer Science	CS500	90 Min	25	1 Page
<b>Exam. Instructions : <u>ANSWER ALL QUESTIONS</u></b>				

(e) Excess

**Solution:**

$$(a) (10000)_2 = (1 * 2^4 + 0 * 2^3 + 0 * 2^2 + 0 * 2^1 + 0 * 2^0) = (16)_{10}$$

$$(b) (10000)_2 = (1)_{\text{sign}} \text{ and } (0000)_{\text{magnitude}} = (-0)_{10}$$

$$(c) (10000)_2 = (01111)_{1\text{'s complement}} = (-15)_{10}$$

$$(d) (10000)_2 = (10000)_{2\text{'s complement}} = (-16)_{10}$$

$$(e) (10000)_2 = (16)_{\text{Unsigned Integer}} - 16 = (0)_{10}, \text{ Use Excess-16 because excess number is in 5-bits.}$$

**Question Three: (8 Marks)**

Calculate the following operations:

- (a)  $11100.001 - 11010.1101$  (Direct Subtraction)  
 (b)  $13.625 - 27.750$  (Using 10's complement)  
 (c)  $11101.01 - 11001.101$  (Using 1's complement)  
 (d)  $(+4) + (+5)$  (Assuming 2's complement addition in 4-bits)

**Solution:**

$$\begin{array}{r} \phantom{0} \overset{11}{11} \overset{11}{11} \overset{21}{21} \\ \phantom{0} \cancel{0} \cancel{1} \cancel{1} \cancel{0} \cancel{0} \cancel{0} \cancel{1} \cancel{0} \cancel{0} \\ (a) \quad 111\cancel{0}\cancel{0}\cancel{0}\cancel{1}\cancel{0}\cancel{0} \\ - \quad 11010.11101 \\ \hline 00001.00111 \end{array}$$

$$\begin{array}{r} (b) \quad 13.625 \\ - \quad 27.750 \\ \hline 13.625 \\ + \quad 72.250 \quad (10\text{'s complement of } 27.750) \\ \hline 85.875 \quad \text{Because no carry, so the result is (the negative of the 10's complement of 85.875)} \\ - \quad 14.125 \quad (10\text{'s complement of } 85.875) \end{array}$$

$$\begin{array}{r} (c) \quad 11101.010 \\ - \quad 11001.101 \\ \hline 11101.010 \\ + \quad 00110.010 \quad (1\text{'s complement of } 11001.101) \\ \hline 100011.100 \\ + \quad \phantom{000000.000} \rightarrow 1 \end{array}$$

Best Wishes 😊  
Dr./Ahmed Hamza



Cairo University

**Cairo University**  
**Institute Of Statistical Studies And Researches**

**Department:** Computer Science

**Academic Year:** 2016-2017 **Semester:** First

**Date:** 29/11/2016 **Level:** Diploma



Course Title:	Course code:	Time:	Exam marks:	# Exam. Sheets:
Introduction To Computer Science	CS500	90 Min	25	1 Page

**Exam. Instructions : ANSWER ALL QUESTIONS**

0 0 0 1 1 . 1 0 1

(d)  $(+4) + (+5) = (+9)$

$$\begin{aligned}
 \text{But the decimal range of 2's complement in 4-bits range} &= -(2^{n-1}) \text{ To } +(2^{n-1} - 1) \\
 &= -(2^{4-1}) \text{ To } +(2^{4-1} - 1) \\
 &= -(2^3) \text{ To } +(2^3 - 1) \\
 &= -8 \text{ To } +7 \\
 &= [-8, +7]
 \end{aligned}$$

Because the decimal result is +9 which is out of range,  $+9 > +7$ , so the result is overflow

**Question Four: (6 Marks)**

Assuming a floating-point binary pattern in excess-8 notation of length 12-bits with 1-bit for a sign, 4-bits for exponent and 7-bits for fraction. Find the following:

(a) Code the decimal value  $(-43.5)_{10}$ .

(b) Decode the bit pattern  $(111111111111)_2$  to its equivalent decimal value.

**Solution:**

(a)  $(-43.5)_{10} = (-101011.1)_2$

$43 \div 2 = 21$	$1$	$0.5 * 2 = 1.0$	$1$
$21 \div 2 = 10$	$1$		
$10 \div 2 = 5$	$0$		
$5 \div 2 = 2$	$1$		
$2 \div 2 = 1$	$0$		
$1 \div 2 = 0$	$1$		

$$-101011.1 = -.1010111 * 2^6$$

$$\text{Exponent (e)} = (+6)_{10} \longrightarrow \text{Exponent (e)} = (+6) + 8 = (+14)_{\text{Excess-8}} = (1110)_2$$

$14 \div 2 = 7$	$0$
$7 \div 2 = 3$	$1$
$3 \div 2 = 1$	$1$
$1 \div 2 = 0$	$1$

$$\text{Fraction (f)} = (.1010111)_2$$

$$\text{Sign (s)} = (1)_2$$

Best Wishes 😊  
 Dr./Ahmed Hamza



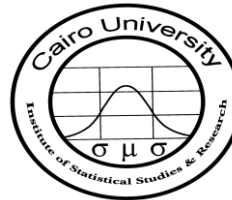
Cairo University

**Cairo University**  
**Institute Of Statistical Studies And Researches**

**Department:** Computer Science

**Academic Year:** 2016-2017    **Semester:** First

**Date:** 29/11/2016    **Level:** Diploma



<b>Course Title:</b> Introduction To Computer Science	<b>Course code:</b> CS500	<b>Time:</b> 90 Min	<b>Exam marks:</b> 25	<b># Exam. Sheets:</b> 1 Page
--	------------------------------	------------------------	--------------------------	----------------------------------

**Exam. Instructions : ANSWER ALL QUESTIONS**

<i>s (1-bit)</i>	<i>e (4-bit)</i>	<i>f (7-bit)</i>
<i>1</i>	<i>1110</i>	<i>1010111</i>

*(b) Divide  $(111111111111)_2$  into  $s(1\text{-bit})$ ,  $e(4\text{-bit})$  and  $f(7\text{-bit})$*

<i>s (1-bit)</i>	<i>e (4-bit)</i>	<i>f (7-bit)</i>
<i>1</i>	<i>1111</i>	<i>1111111</i>

$$s = (1)_2 = - \text{(negative)}$$

$$f = (.1111111)_2$$

$$e = (1111)_2 = (+15)_{\text{Excess-8}} = (+15) - 8 = (+7)_{10}$$

$$\begin{aligned} -.1111111 * 2^{+7} &= (-1111111.0) \\ &= -(64 + 32 + 16 + 8 + 4 + 2 + 1) \\ &= (-127)_{10} \end{aligned}$$

---

Best Wishes 😊  
 Dr./Ahmed Hamza

