The University of British Columbia
CPSC 121 Section 202 Test 1
Wednesday, January 28th, 2015

Name: _____

Student ID: _____

Signature: _____

Question	Marks
1	/8
2	/7
3	/5
Total	/20

– You have 30 minutes to write the questions on this examination.
– You are only allowed to bring in one double-sided 8.5 x 11in sheet of notes, either handwritten or printed using a font size of at least 11pt.
– Keep your answers short. If you run out of space for a question, you have written too much.
– The number in square brackets to the left of the question number indicates the number of marks allocated for that question. Use these to help you determine how much time you should spend on each question.
– Good luck!

UNIVERSITY REGULATIONS:
– Each candidate should be prepared to produce, upon request, his/her UBC card.

– No candidate shall be permitted to enter the examination room after the expiration of one half hour, or to leave during the first half hour of the examination.

– CAUTION: candidates guilty of any of the following, or similar, dishonest practices shall be immediately dismissed from the examination and shall be liable to disciplinary action:
  1. Having at the place of writing, or making use of, any books, papers or memoranda, electronic equipment, or other memory aid or communication devices, other than those authorized by the examiners.
  2. Speaking or communicating with other candidates.
  3. Purposely exposing written papers to the view of other candidates. The plea of accident or forgetfulness shall not be received.

– Candidates must not destroy or mutilate any examination material; must hand in all examination papers; and must not take any examination material from the examination room without permission of the invigilator.

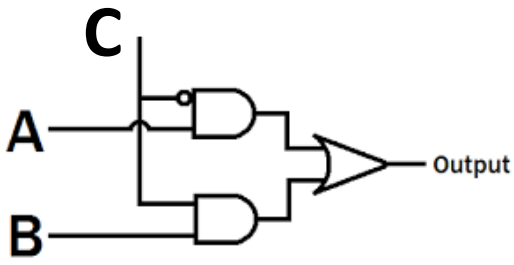
[8] Q1. Perform the following data representation conversions. Show your work on the left to justify your answer; CIRCLE ONE answer on the right.

a	[2] Convert 27 decimal into an unsigned binary representation with 8 bits.	i 11011000 ii. 00011011 iii. 10100111 iv. 00100111 v. none of the above
b	[2] Convert -27 into a signed binary representation (2's complement) with 8 bits.	i 01100101 ii. 11100101 iii. 10100111 iv. 00100111 v. none of the above
c	[2] The character 'A' (the capital letter 'a') has as ASCII code value of 65 decimal. Convert 65 decimal into a hexadecimal representation.	i 3A ii. 41 iii. 2F iv. 14 v. none of the above
d	[2] Convert the signed binary value 01000001 (in 2's complement) into a decimal representation.	i 129 ii. 65 iii. 515 iv. -65 v. none of the above

[7[Q2. Propositional logic statements, truth tables, and circuits.

a. [2] Write a propositional logic statement for the following circuit:

(C /\B) \/ (A /\ ~C)



b. [2] Draw a truth table for your propositional logic statement:

A	B	C	B/\C	A/\~C	(C /\B) \/ (A /\ ~C)
0	0	0	0	0	0
0	0	1	0	0	0
0	1	0	0	0	0
0	1	1	1	0	1
1	0	0	0	1	1
1	0	1	0	0	0
1	1	0	0	1	1
1	1	1	1	0	1

c. [3] Simplify your propositional logic statement using logical equivalences:

one answer: already simplified: (C /\B) \/ (A /\ ~C)

alternative answers, convert into nand, nor gate solution

[5] Q3. Design a circuit for a seatbelt warning light in a vehicle. The circuit has three inputs, each one coming from a sensor (s, k, p):

s: this sensor input indicates if the seat belt is fastened

k: this sensor input indicates if the key is inserted in the ignition

p: this sensor input indicates if a person is in the driver's seat.

Assume the seatbelt warning light is only for one seat in the vehicle (driver's).
State any additional assumptions you need to make.

a. [3] What condition(s) would you specify for the seatbelt warning light to be on? Justify your answer.
   - Present this as a truth table or a propositional logic statement (un-simplified).

let w be the warning light is on

$w = k \wedge p \wedge \sim s$
the warning light should be on when someone is in the driver's seat and the key is in the ignition and the seat belt is not fastened.

s	k	p	W
0	0	0	0
0	0	1	0
0	1	0	0
0	1	1	1
1	0	0	0
1	0	1	0
1	1	0	0
1	1	1	0

b. [2] Draw your circuit.