Computer Sciences – 02/02/2018 – **total time: 2h**

SURNAME:		NAME:		**B1**
STUDENT ID:				
PROFESSOR:				

Question 1	Answers
Given the following 8-bit binary numbers A=11110001, B=01110100 compute their sum, when considered in pure binary (PB) and in two's complement (2C). For any operation, indicate if there is overflow or not.	$A_{PB}+B_{PB}$ =_____ overflow:____ $A_{2C}+B_{2C}$ =_____ overflow:____

Most relevant steps

Question 2	Answer

Given the following declaration in C language:
``
typedef struct {
   char Title[50];
   char Album[50];
   char Author[100];
   int Track_id;
} Song;
Song LP[20];
``
 	
Determine the minimum amount of memory required to allocate the array `LP` in a computer that stores integers in 32 bits.	

Question 3
Briefly explain the phases composing the execution cycle of an instruction in a microprocessor.

Question 4 (Programming)

Write a C program for analyzing the data of the accesses to a museum equipped with an electronic access control system. Each visitor of the museum receives a nominative magnetic card to be used to enter and to exit the museum.

The system records the data of the visitors in a text file named "`visits.txt`". **The length of the file is NOT known in advance**, but the file format is always correct. Each line in the file contains information about the access of the visitor, according to the following format:
`<card_number> <visit_date> <enter_time> <exit_time> <birthdate>`

The entrances are ordered by date and time. The card number is an alphanumeric string composed of 5 digits. The visit date and the birthdate are two strings expressed in the format DD/MM/YYYY. The enter time and the exit time are two strings expressed in the format HH:MM:SS. Visitors pay a fee according to three ranges of age: 0-10 years old, 11-17 years old, 18 years old and above. Fee prices for the three ranges are stored in a text file named "`prices.txt`". The file reports the three prices in euros, one for each line, expressed in euros with the precision of a euro cent.

Write a program able to elaborate statistics of the visits over a reference year. The program receives (1) the reference year as the first command line parameter, and (2) a character as the second parameter, which indicates the kind of statistics to compute. The character can be one of the following:
- 'S': the program shall print the number of visitors of the year, the total income of the year, and the average duration expressed in minutes of the visits of the year.
- 'G': other than the two command line parameters, the program receives further parameters (10 additional parameters at maximum), each one corresponding to a card number, and shall print how many of them have visited the museum more than once in two consecutive days.

visits.txt	prices.txt
`00001 01/05/2016 03:00:00 03:45:00 15/05/1980`	`5.50`
`00002 01/03/2017 04:10:00 04:25:00 15/05/2012`	`15.00`
`00005 01/03/2017 04:55:00 05:45:00 01/02/1990`	`21.00`
`00001 02/03/2017 03:40:00 03:55:00 15/05/1980`	
`00002 02/03/2017 03:21:00 04:45:00 15/05/2012`	
`00001 03/03/2017 03:00:00 03:45:00 15/05/1980`	
`00001 04/03/2017 03:21:00 03:45:00 15/05/1980`	
`00004 04/05/2017 05:23:00 06:45:00 15/05/2015`	

EXAMPLE command line parameters:
c:\> progname.exe 2017 S
`Total number of visits of 2017 is 7`
`Total income of 2017 is 100.5 euro`
`Average visiting time of 2017 is 45 minutes`

c:\> progname.exe 2017 G 00001 0002 0004
`2 people visited the museum more than once in less than two days.`

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SURNAME:		NAME:		**B2**
STUDENT ID:				
PROFESSOR:				

Question 1	Answers
Given the following 8-bit binary numbers A=11110001, B=10000100 compute their sum, when considered in pure binary (PB) and in two's complement (2C). For any operation, indicate if there is overflow or not.	$A_{PB}+B_{PB}$ =_____ overflow:_____ $A_{2C}+B_{2C}$ =_____ overflow:_____

Most relevant steps

Question 2	Answer

Given the following declaration in C language:
`typedef struct {`
`   char Name[100];`
`   char Language[30];`
`   char OS[20];`
`   int OS_Version;`
`} Software;`
`Software package[100];`
 	
Determine the minimum amount of memory required to allocate the array `package` in a computer that stores integers in 32 bits.	

Question 3
Briefly explain the role of the program counter in the execution of a program.

Question 4 (Programming)

Write a C program for analyzing the data of the accesses to a museum equipped with an electronic access control system. Each visitor of the museum receives a nominative magnetic card to be used to enter and to exit the museum.

The system records the data of the visitors in a text file named "`visits.txt`". **The length of the file is NOT known in advance**, but the file format is always correct. Each line in the file contains information about the access of the visitor, according to the following format:
`<visit_date> <card_number> <enter_time> <exit_time> <birthdate>`

The entrances are ordered by date and time. The card number is an alphanumeric string composed of 5 digits. The visit date and the birthdate are two strings expressed in the format DD/MM/YYYY. The enter time and the exit time are two strings expressed in the format HH:MM:SS. Visitors pay a fee according to three ranges of age: 0-10 years old, 11-17 years old, 18 years old and above. Fee prices for the three ranges are stored in a text file named "`prices.txt`". The file reports the three prices in euros, one for each line, expressed in euros with the precision of a euro cent.

Write a program able to elaborate statistics of the visits over a reference year. The program receives (1) the reference year as the first command line parameter, and (2) a character as the second parameter, which indicates the kind of statistics to compute. The character can be one of the following:
- 'S': the program shall print the number of visitors of the year, the average income per visitor of the year, and the average age of the visitors.
- 'G': other than the two command line parameters, the program receives further parameters (10 additional parameters at maximum), each one corresponding to a card number, and shall print how many of them have visited the museum more than one time in no consecutive days.

visits.txt	prices.txt
`01/05/2016 00001 03:00:00 03:45:00 15/05/1980`	`5.50`
`01/03/2017 00002 04:10:00 04:25:00 15/05/2012`	`15.00`
`01/03/2017 00005 04:55:00 05:45:00 01/02/1990`	`21.00`
`02/03/2017 00001 03:40:00 03:55:00 15/05/1980`	
`02/03/2017 00002 03:21:00 04:45:00 15/05/2012`	
`03/03/2017 00001 03:00:00 03:45:00 15/05/1980`	
`04/03/2017 00001 03:21:00 03:45:00 15/05/1980`	
`04/05/2017 00004 05:23:00 06:45:00 15/05/2015`	
`10/03/2017 00005 04:33:00 05:24:00 01/02/1990`	

EXAMPLE command line parameters:
c:\> progname.exe 2017 S
`Total number of visits of 2017 is 8`
`Average income per visitor of 2017 is 15.18 euro`
`Average age of visitors of 2017 is 21.38 years`

c:\> progname.exe 2017 G 00001 0002 0004 0005
`1 person visited the museum more than once in more than two days.`