T.C.
DOKUZ EYLUL UNIVERSTY

FACULTY OF ENGINEERING

DEPARTMENT OF COMPUTER ENGINEERING

2022 – 2023
SPRING SEMESTER

CME 3208
PRINCIPLES OF EMBEDDED SYSTEMS

LAB 1:
5–BIT LED COUNTER

DUE DATE:
23:55 – 21.03.2023

In this lab, you are required to make a 5–bit LED counter, that works based on two global integer variables. These variables are given below:

int INCREMENT_VALUE = 1;
 # This global variable is used to store the increment value of 5-Bit LED counter. The default value is 1.

int WAIT_TIME = 500;
 # This global variable is used to store the number of milliseconds that must pass for the next iteration of 5-Bit LED counter. The default value is 500 milliseconds (0.5 seconds).

The first value would be used for increment operation. You should check if this value is between 1 and 31 (including both values). If it is not, just take a modulus of this number in respect to 32 and start operation (including for negative numbers). For 0, this circuit will not work.

The second value is for wait time between counting operation (representing milliseconds). You should check if this value is a positive integer. If it is not, you program should not work.

In table below, you can see which LEDs should be turned on to represent the corresponding integer value. The empty cell represents an idle LED and light bulb represents an active LED. This table also shows the operation of this circuit if the increment value was 1. After it reaches to value 31, it will start from 0 again.

DECIMAL VALUE	BINARY VALUE	LED 5	LED 4	LED 3	LED 2	LED 1	DECIMAL VALUE	BINARY VALUE	LED 5	LED 4	LED 3	LED 2	LED 1
0	00000						16	10000	💡				
1	00001					💡	17	10001	💡				💡
2	00010				💡		18	10010	💡			💡	
3	00011				💡	💡	19	10011	💡			💡	💡
4	00100			💡			20	10100	💡		💡		
5	00101			💡		💡	21	10101	💡		💡		💡
6	00110			💡	💡		22	10110	💡		💡	💡	
7	00111			💡	💡	💡	23	10111	💡		💡	💡	💡
8	01000		💡				24	11000	💡	💡			
9	01001		💡			💡	25	11001	💡	💡			💡
10	01010		💡		💡		26	11010	💡	💡		💡	
11	01011		💡		💡	💡	27	11011	💡	💡		💡	💡
12	01100		💡	💡			28	11100	💡	💡	💡		
13	01101		💡	💡		💡	29	11101	💡	💡	💡		💡
14	01110		💡	💡	💡		30	11110	💡	💡	💡	💡	
15	01111		💡	💡	💡	💡	31	11111	💡	💡	💡	💡	💡

Another example operation of this circuit with given global variables is given below:

GLOBAL VARIABLES:

```
int INCREMENT_VALUE = 7;
int WAIT_TIME = 500;
```

RESULTS:

TIME (MILLISECONDS)	DECIMAL VALUE	BINARY VALUE	LED 5	LED 4	LED 3	LED 2	LED 1
0	0	00000					
500	7	00111			💡	💡	💡
1000	14	01110		💡	💡	💡	
1500	21	10101	💡		💡		💡
2000	28	11100	💡	💡	💡		
2500	3 (35 mod 32)	00011				💡	💡
3000	10	01010		💡		💡	
3500	17	10001	💡				💡
4000	24	11000	💡	💡			
4500	31	11111	💡	💡	💡	💡	💡
5000	6 (38 mod 32)	00110			💡	💡	
Operation can continue infinite more times…							

Please use Tinkercad online simulator to create and test your design before creating the circuit using your Arduino. This will allow you to design your circuit without experiencing connectivity or similar hardware problems.

You are advised to use Tinkercad individually (for every group member) first to design the circuit and code to understand it better and gain experience. Next you should create your circuit as a group by meeting in real life if possible or having an online meeting if it is not possible.

Make sure you use resistors with every connection and circuit with your Arduino board. Otherwise you might burn the port you are using (Digital 10 for example) or even your whole Arduino board. This is also true for circuit elements as well (temperature and humidity sensor for example).

UPLOAD REQUIREMENTS:

You are required to upload three different files for this assignment. First is a text file that contains your source code for your circuit. Second is a Tinkercad screenshot showing your circuit after your design is finished. Third is a video file showing your circuit that has been created using lab supplies.

For your video, you are expected to introduce yourself and your teammates, showing your student IDs in video too. If your group are working online rather than meeting in real life, you do not have to show the ID cards of students who are not physically present.

You are also expected to explain your circuit in a brief but complete manner and show its execution. This video should not be too long (a maximum of 3 to 5 minutes is acceptable) and should not be too large otherwise you will not be able to upload to Sakai (check the maximum allowed file size for upload to Sakai). You should also consider choosing resolution 720p over 1080p or larger for smaller file size (make sure your circuit is still visible and understandable over this resolution). You can also change your video format to a more space efficient one.

You should show your circuit execution with three different set of "INCREMENT_VALUE". First one (a copy of our first table), then 7 (a copy of our second table) and another random value you choose between 1 and 31.

The naming of your files should follow the format below for 3 person groups. For 2 or 4 person groups just write 2 or 4 student numbers in ascending order. You should write your group numbers with one leading zero if it is between 1 and 9, normally for 10 and above.

The file extension for screenshot (Tinkercad) and video does not have to be "jpg" and "mp4", you can use other formats as well like "png" or "mkv" or etc. However, make sure you use commonly used image and video formats, if we cannot open it on our computers, you grade related to them will be zero. In addition your source code file extension could be either "c" or "ino", do not leave it as "txt".

Do not "zip" or "rar" requested files and upload them. It is not necessary and it makes it harder for us to evaluate your assignments. Please upload 3 files as they are without compressing them to a single file.

FORMAT:
GROUP_<group_number>_<student_number_1>_<student_number_2>_<student_number_3>_CODE.c
GROUP_<group_number>_<student_number_1>_<student_number_2>_<student_number_3>_TINKERCAD.jpg
GROUP_<group_number>_<student_number_1>_<student_number_2>_<student_number_3>_VIDEO.mp4

EXAMPLE:
GROUP_01_2023510123_2023510124_2023510125_CODE.c
GROUP_01_2023510123_2023510124_2023510125_TINKERCAD.jpg
GROUP_01_2023510123_2023510124_2023510125_VIDEO.mp4

You are expected to write your own code for algorithms instead of using an available method for calculations. If you use such as a method that makes this assignment trivial to code, your grade for coding will be zero.

Your uploaded source codes (as well as your circuit design) will be checked for cheating and plagiarism. If cheating is detected, your entire assignment will be graded zero. If you or other students copy your code from an online source rather than writing it yourself, it will be considered as cheating as well.

Make sure that you upload your correct assignment to correct upload section. If you accidentally upload another assignment (from another class for example) or to an incorrect upload (other section's upload), it will be considered as not turned in and it will be graded as zero. Worst of all, you will only realize it after grades are published and it will too late to fix it.

If you have any questions or problems regarding this lab paper, you can ask about it in our lab sessions. If you wish, you can also ask it in class forums or assignment page comments. If you send an email and if your question is answered, please share this information with other students to prevent asking of the same question again and again.

Your assignment will be open for upload until 23:55, 22.03.2023. This is done to allow students who may experience extreme problems (no Internet or electricity, computer crash or failure, etc.) and miss the deadline as a result. This one day extension will allow them to upload. If you are still unable to upload, send us an email informing your situation and at the same time, try everything you can to make your assignment upload.

Lastly, please do not forget to click "Submit" button after you upload your assignment files. If you do not, even though your files are uploaded to Sakai, you are labeled as "No Submission" and ignored when we try to download your assignments, making your uploaded files invisible to us, leading us to assume you did not make assignment submission.

GOOD LUCK TO YOU ALL!