Birla Institute of Technology and Science, Pilani Campus

EEE G512 EMBEDDED SYSTEMS DESIGN

Mid-semester exam, Academic year - 2017-18, Semester I

10th October 2017

Duration - 90 minutes **Maximum Marks - 40**

- ***Avoid overwriting and cuttings while writing the code.***
- *Use relevant variable, label and procedure names.*
- *Provide comments wherever required.*
- *Marks shall be deducted for syntax errors etc.*

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1. For LPC2148 SoC, a software system call, number 0x55 need to be implemented in assembly language. This system call is used to measure the CPU temperature and raise an alarm if the CPU is overheated. Assume ARM mode of operation. Temperature readings are measured using ADC0 of LPC2148 and the ADC reading is available in raw 10 bit format in arm register R3, you need not to write the code for ADC initialization or control. Threshold value of temperature to activate the alarm is equal to half of the full scale ADC value (1024). Also assume that all the GPIO settings are already done and you just need to write appropriate bits in IOSET register to raise the alarm. Buzzer is connected to P0.10. IO0SET address is 0xE0028004.

A. What will be the address location where the PC should jump to when system call is made? [1]
B. What should be the instruction at that address (answer from A) location in order to properly handle the system call? [3]
C. Write the assembly code for system call handler. Do not assume any automation of procedures from assembler. [12]

2. Write a minimal assembly language program to initialize the interrupt vector table in the memory addressed by the arm processor. Assume no remapping of IVT. [6]

3. Convert following C procedure into corresponding ARM mode assembly language procedure. Follow APCS for arguments and return types [10]

```
int checksum(int *data, unsigned int N)
{
        int sum=0;
        do
        {
                sum += *(data++);
        }while(--N!=0);
        return sum;
}
```

4. Draw petri net diagram to specify the behavior of a safe box with electronic code lock system with following specifications. [8]

- Door of the safe has 3 states, locked (S1), unlocked but door closed (S2) and door open (S3). Any other intermediate states (e.g. checking passcode) can be assumed if required. Also assume that timings, if any, are associated with petri net places as usual.
- If the door is in closed but unlocked condition for more than 5 seconds it should get locked automatically.
- If the door is kept open for more than 10 minutes, it should activate an audible alarm till it is closed manually.
- If correct passcode is entered, the door will get unlocked and may be opened by the user.

Clearly specify the purpose of every place and transition used in your petri net in a separate table.
