ECE 362 Final Project Notes

General notes about the assignment:

Before you start working on your final project:

- You must have all Check-Outs from Lab 3 to Lab 7!
- If you work with a partner, they must also have all Check-Outs!
- Approach the TAs to be assigned one project.

How to start your final project:

- Read through your project requirements thoroughly. Be careful not to miss any details.
- Create a block diagram to arrange your thoughts for the overall project. While it is not necessary to have one until your Final Project Report, it is **strongly recommended**.
- Download Final_Project.zip from the "Final Project" folder in Canvas.
- Read the rest of this document!

Final Project Demonstration & Report:

- Your final project will be graded in two parts:
    - Project Demonstration (160 points)
    - Final Project Report (40 points)
- Project demonstration due Friday, December 7 at 5:59 p.m.
- Final Project Report due Friday, December 14 at 11:59 p.m.
- All necessary information is provided in the "Final Project" folder in Canvas.

Notes about peripherals:

- The Push Button (PB) is connected to Port P on bit 5. Its polarity is set similarly to the keypad in that a logic low means that the button is depressed. However, Port P's DDR should still be sent $1E for the stepper motor to function.
- INTCR $80 sets the edge trigger.
- INTCR $40 enables the IRQ. The IRQ must be defined in the interrupt vectors, e.g. "VECTOR 6 irq_FUNCTION"

Speaker Control Tips

NOTE: Please beware that the SendsChr.c provided in Final_Project.zip is different from the one that you used in Lab 6.2.

To use SendsChr.c:

1) Place jumper J6 on the lower two pins. It is located next to the potentiometer for the amplifier.
2) Make sure that potentiometer for the amplifier is turned up loud enough to hear.
3) Make sure to reference both functions in SendsChr.c (SendsChr and PlayTone) using the XREF directive.
4) Set bit 5 of Port_T_DDR to output.

5) Pass the 8-bit value that you desire the speaker to use on the stack to SendsChr in the same manner you did for Lab 6.
6) Set the RTI control register (RTICTL) to $10 to get a wide range of tones in speaker.
7) Within your real time interrupt service routine, call PlayTone using the JSR instruction.

Since the way the code was written is different from in Lab 6.2, you must determine the values that you need to send to the speaker. The code here creates a square wave which is sent to the speaker. This square wave is created by toggling bit 5 of Port T at a specified interval. This interval is the equivalent of the 8-bit value that you send to SendsChr.c multiplied by the period of your RTI.

For example, if you set the RTI control register (RTICTL) to $10, this will yield a real time interrupt period of .000128 ms or a frequency of 7812.5 Hz. If you send 5 to SendsChr.c in this case, you will get a resulting frequency of 1/(5*.000128) = 1562.5 Hz. This is the tone that will be generated by the speaker. Keep in mind that you will need to have a relatively high RTI frequency (small period) to get a wide range of tones.

Here is some information about musical notes that was produced by a previous TA. The highlighted values are the range of notes that we have found to be the most accurate:

Note	Frequency (Hz)	T (mS)
C_3	130.81	7.644675
$C^{\#}_3/D^{b}_3$	138.59	7.215528
D_3	146.83	6.810597
$D^{\#}_3/E^{b}_3$	155.56	6.428388
E_3	164.81	6.067593
F_3	174.61	5.727049
$F^{\#}_3/G^{b}_3$	185	5.405405
G_3	196	5.102041
$G^{\#}_3/A^{b}_3$	207.65	4.815796
A_3	220	4.545455
$A^{\#}_3/B^{b}_3$	233.08	4.290372
B_3	246.94	4.049567
C_4	261.63	3.822192
$C^{\#}_4/D^{b}_4$	277.18	3.607764
D_4	293.66	3.405299
$D^{\#}_4/E^{b}_4$	311.13	3.214091
E_4	329.63	3.033704
F_4	349.23	2.863442
$F^{\#}_4/G^{b}_4$	369.99	2.702776
G_4	392	2.55102
$G^{\#}_4/A^{b}_4$	415.3	2.407898
A_4	440	2.272727
$A^{\#}_4/B^{b}_4$	466.16	2.145186
B_4	493.88	2.024783
C_5	523.25	1.911132
$C^{\#}_5/D^{b}_5$	554.37	1.803849
D_5	587.33	1.70262
$D^{\#}_5/E^{b}_5$	622.25	1.607071
E_5	659.26	1.516852
F_5	698.46	1.431721

Note	Frequency (Hz)	T (mS)
$F^{\#}_5/G^{b}_5$	739.99	1.35137
G_5	783.99	1.275526
$G^{\#}_5/A^{b}_5$	830.61	1.203934
A_5	880	1.136364
$A^{\#}_5/B^{b}_5$	932.33	1.072582
B_5	987.77	1.012381
C_6	1046.5	0.955566
$C^{\#}_6/D^{b}_6$	1108.73	0.901933
D_6	1174.66	0.85131
$D^{\#}_6/E^{b}_6$	1244.51	0.803529
E_6	1318.51	0.758432
F_6	1396.91	0.715866
$F^{\#}_6/G^{b}_6$	1479.98	0.675685
G_6	1567.98	0.637763
$G^{\#}_6/A^{b}_6$	1661.22	0.601967
A_6	1760	0.568182
$A^{\#}_6/B^{b}_6$	1864.66	0.536291
B_6	1975.53	0.506193
C_7	2093	0.477783
$C^{\#}_7/D^{b}_7$	2217.46	0.450966
D_7	2349.32	0.425655
$D^{\#}_7/E^{b}_7$	2489.02	0.401765
E_7	2637.02	0.379216
F_7	2793.83	0.357932
$F^{\#}_7/G^{b}_7$	2959.96	0.337842
G_7	3135.96	0.318882
$G^{\#}_7/A^{b}_7$	3322.44	0.300984
A_7	3520	0.284091
$A^{\#}_7/B^{b}_7$	3729.31	0.268146
B_7	3951.07	0.253096