# APPENDIX

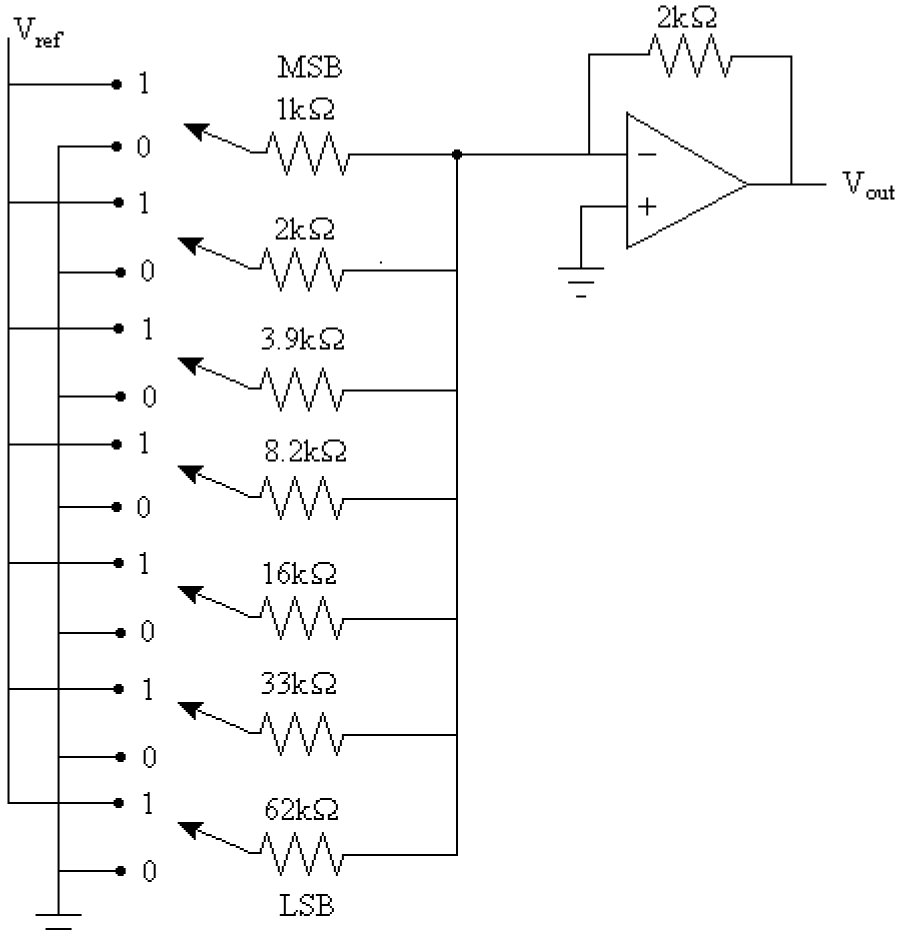


Figure 1: Binary ladder used to convert digital signal to analog voltage. (note that the figure caption is below the figure.)

Table 1: 7-bit Binary Ladder

| **Bit** | 6 | 5 | 4 | 3 | 2 | 1 | 0 | **$V_{out}$ [V]** | |
|---|---|---|---|---|---|---|---|---|---|
| **Resistance [kΩ]** | 1 | 2 | 3.9 | 8.2 | 16 | 33 | 62 | theoretical | measured |
| **Binary Number** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 1 | 0 | 0 | 0 | 0 | 0 | 0 | -5.04 | -5.08 |
| | 1 | 1 | 1 | 1 | 1 | 1 | 1 | -10.00 | -10 |
| | 0 | 0 | 0 | 0 | 0 | 0 | 1 | -0.08 | -0.081 |
| | 1 | 1 | 0 | 0 | 0 | 0 | 0 | -7.56 | -7.59 |
| | 1 | 1 | 1 | 0 | 0 | 0 | 0 | -8.82 | -8.9 |
| | 1 | 1 | 1 | 1 | 0 | 0 | 0 | -9.45 | -9.51 |
| | 1 | 1 | 1 | 1 | 1 | 0 | 0 | -9.76 | -9.82 |
| | 1 | 1 | 1 | 1 | 1 | 1 | 0 | -9.92 | -9.96 |
| | 0 | 1 | 1 | 1 | 1 | 1 | 1 | -4.96 | -4.99 |

(Note that the caption for the table is located above the table)

```
m=2.9966; L=.922; x=[.008 .038 .099 .16 .237 .313 .465 .618 .77 .922];
L=x(10);
T=[107.5 98.8 86.3 76.6 65.4 58.1 47 40.4 36.2 32.9];
Tb=121.8; Ta=25.1; thetab=Tb-Ta;
theta=T-Ta;
for i=1:10
   arg =m*(L-x(i));
   a(i)=sinh(arg)*theta(i)/thetab;
   b(i)=sinh(arg)*cosh(arg);
   c(i)=cosh(arg)*theta(i)/thetab;
   d(i)=sinh(arg)^2;
   e(i)=cosh(arg)^2;
end
den=sum(b)^2-sum(e)*sum(d);

A=(sum(a)*sum(b)-sum(c)*sum(d))/den
B=(sum(c)*sum(b)-sum(a)*sum(e))/den

% Now the variance can be solved
num=ones(1,10);
for i=1:10
   arg=m*(L-x(i));
   num(i)=(theta(i)/thetab-A*cosh(arg)-B*sinh(arg))^2;
end
S=sum(num)/8
```

(Any computer code should conclude the Appendix)