EXERCISE: Consider a galaxy cluster (populated by elliptical galaxies E, mainly) having $M/L_B=250\ (M/L)_{sun}$. Using tables below, compute M/L_R.

SOLUTION: From table of the sun mag, $(B-R)_{sun}=5.48-4.31=1.17$.

From table of galaxy colors (at z=0), $(B-R)_E=(B-V)_E+(V-R)_E=0.96+0.61=1.57$. This is true for the cluster, too.

From color definition $(B-R)_E=-2.5\log(L_B/L_R)$, i.e. $(L_B/L_R)_E=10^{[-0.4*(B-R)_E]}$

and similarly $(L_B/L_R)_{sun}=10^{[-0.4*(B-R)_{sun}]}$

Now: $(M/L_R)/(M/L_R)_{sun}=(M/L_B)*(L_B/L_R)\ /\ [(M/L_B)_{sun}*L_{B,sun}/L_{R,sun}]=$

$=(M/L_B)/(M/L_B)_{sun}*(L_B/L_R)/(L_{B,sun}/L_{R,sun})=250\ *\ 10^{[-0.4*(B-R)_E]}\ /10^{[-0.4*(B-R)_{sun}]}=$

$=250*10^{[-0.4[(B-R)_E-(B-R)_{sun}]]}=250*10^{[-0.4*0.4]}=250*0.692=173$

i.e. $(M/L_R)=173\ (M/L_R)_{sun}$

Galaxy Colors

(a) Standard Johnson-Morgan/Cousins (A0V)

type	$U-B$	$B-V$	$V-R_C$	R_C-I_C	$V-R_J$	R_J-I_J
E	0.64	0.96	0.61	0.70	0.71	0.73
S0	0.42	0.85	0.54	0.61	0.63	0.63
Sab	0.33	0.78	0.56	0.65	0.66	0.68
Sbc	0.00	0.57	0.52	0.62	0.60	0.65
Scd	−0.08	0.50	0.50	0.57	0.57	0.60
Im	−0.35	0.27	0.31	0.33	0.34	0.33

SUN ABS MAG

Filter	B&M
U	5.61
B	5.48
V	4.83
R	4.42
I	4.08
J	3.64
H	3.32
K	3.28