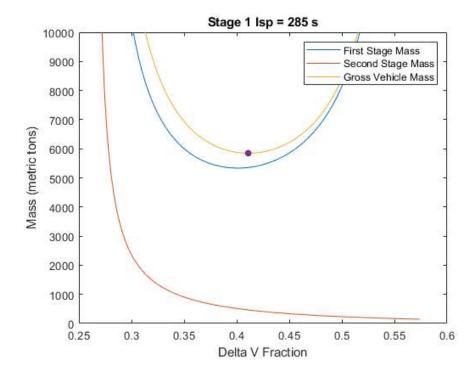
```
%Sara C 1.2a Code
%Looking at mixture of:
%Stage 2: LOX/LH2
%Varied Stage 1: LOX/LCH4, LOX/LH2, LOX/RP1, Solid, Storables
%Variables & Given Parameters
delta1 = 0.08;
delta2 = 0.08;
payload = 26000; %kg
%Specific Impulse
Isp_s2 = 366; %stage 2
%LCH4, LH2, RP1, solids, storables
Isp = [327, 366, 311, 269, 285]; %stage 1 varies
%initialize X (this is delta_V ratio/fraction)
X=0:0.001:1;
for isp = 1:length(Isp)
               %mass arrays
                m s1 = [];
                m s2 = [];
                m_0 = [];
                min_gross_mass = realmax;
                for i = 1:length(X)
                                %calling mass function to populate mass arrays % \left( \left( 1\right) \right) =\left( 1\right) \left( 1\right) 
                                [m_in1, m_in2, m_pr1, m_pr2, m0] = mass_function(Isp(isp), Isp_s2, X(i), delta1, delta2);
                                m_s1 = [m_s1 (m_pr1 + m_in1)];
                                m_s2 = [m_s2 (m_pr2 + m_in2)];
                                m_0 = [m_0 m0];
                                %min gross mass function - returns the x,y minimum of the m_0 array
                                if m_s1(i) > 0 \&\& m_s2(i) > 0 \&\& m_0(i) < min_gross_mass
                                                min_gross_mass = m_0(i); %convert to metric tons
                                                x_{min} = X(i);
                                end
                end
                %kg to metric tons
                m_s1 = m_s1/1000;
                m_s2 = m_s2/1000;
                m_0 = m_0/1000;
                min_gross_mass = min_gross_mass/1000;
                %output - min mass and corresponding deltaV
                fprintf('Stage 1 Isp = %d s --> Optimum at X = %.3f, Min Gross Mass = %.2f metric tons\n', Isp(isp), x_min, min_gross_mass);
                %plotting
                plot(X, m_s1);
                hold on;
                plot(X, m_s2);
                plot(X, m_0);
                plot(x_min, min_gross_mass, '.', MarkerSize=20);
                ylim([0, 1e4]);
                title(sprintf('Stage 1 Isp = %d s', Isp(isp)))
                legend("First Stage Mass", "Second Stage Mass", "Gross Vehicle Mass")
                xlabel("Delta V Fraction");
                ylabel("Mass (metric tons)")
                hold off;
end
```

```
Stage 1 Isp = 327 s --> Optimum at X = 0.456, Min Gross Mass = 3680.72 metric tons Stage 1 Isp = 366 s --> Optimum at X = 0.500, Min Gross Mass = 2582.05 metric tons Stage 1 Isp = 311 s --> Optimum at X = 0.438, Min Gross Mass = 4337.65 metric tons Stage 1 Isp = 269 s --> Optimum at X = 0.438, Min Gross Mass = 7209.12 metric tons Stage 1 Isp = 285 s --> Optimum at X = 0.411, Min Gross Mass = 5848.23 metric tons
```



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