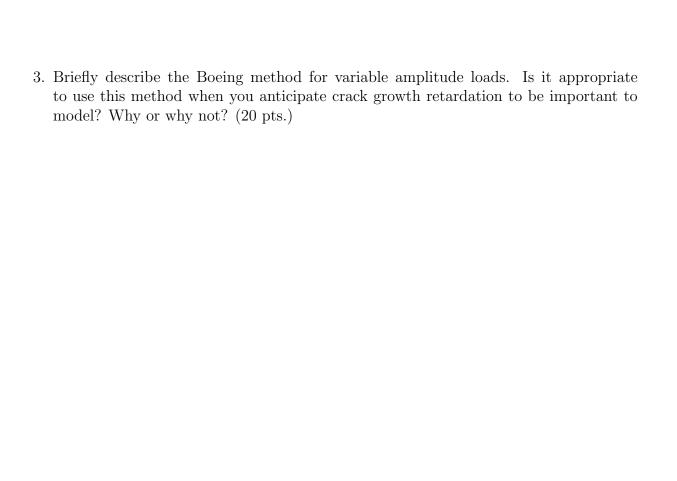
Name:

Exam 2

1. Estimate the cycles (using stress-based fatigue) to failure for a notched part made from Aluminum 2024-T4 with $\sigma'_f = 131$ ksi, b = -0.102 and E = 10.6 Msi. The notch has a stress concentration factor of $K_t = 2.5$, a radius of $\rho = 0.5$ in and $\alpha = .02$ in. If the part is subjected to a loading block with 10 cycles of fully reversed 10 ksi, 5 cycles of $\sigma_{max} = 25$, $\sigma_{min} = 5$ ksi and 10 cycles of $\sigma_{max} = 20$, $\sigma_{min} = 0$ ksi per block, find the total number of blocks it can sustain. (20 pts.)

2. A part made from 7075-T6 aluminum has material properties of E=10.3 (Msi), $\sigma_f'=213$ (ksi), b=-0.143, $\epsilon_f'=2.62$, c=-0.619. Find the transition life and comment on the appropriateness of fatigue analysis methods above and below this point. What is the meaning of the transition life? (20 pts.)



4. A wide, edge-cracked specimen ($\beta=1.122$) with Paris law parameters $C=10^{-9}$ and n=4 has fracture toughness of $K_c=120$ ksi $\sqrt{\text{in}}$. The specimen is subjected to an R=0 cyclic stress such that $\sigma_{max}=20.0$ ksi. Assuming an initial crack of a=0.5 in, how many cycles can this sustain before failure? (20 pts.)

5. Use the Boeing method to approximate the following variable amplitude load cycle for a material with $m_T = 25.8$, p = 3.9, q = 0.6, and $\mu = 0.1$. Recall that

$$Z = (1 - R)^{q} \quad \text{for } R \ge 0$$
$$Z = (1 - \mu R)^{q} \quad \text{for } R < 0$$

Would you expect crack retardation to be an important effect when modeling this load cycle? Why or why not? (20 pts.)

