Solutions

2.1

- A: $0.30 \times 4 + 0.30 \times 3 + 0.25 \times 4 + 0.15 \times 3 = \mathbf{3.55}$.
- B: $0.30{\times}5{+}0.30{\times}4{+}0.25{\times}3{+}0.15{\times}2 = \mathbf{3.75}$; C: $0.30{\times}3{+}0.30{\times}4{+}0.25{\times}5{+}0.15{\times}4 = \mathbf{3.95}$.
- C, the gearmotor, wins.

2.2

- A $= \mathbf{3.65}$; B $= 0.45 \times 5 + 0.20 \times 4 + 0.20 \times 3 + 0.15 \times 2 = \mathbf{3.95}$; C $= \mathbf{3.75}$.
- B now wins: the choice flips with a cost-heavy brief, so it is not robust and the weights must be agreed with the client first.

3.1

- Life ratio $49\,100/30\,000 = 1.64$, so the load could rise by $1.64^{1/3} = \mathbf{1.18}$ before the life falls short.
- The gear's 1.66 is the lowest of the stress factors, but on load the bearing's 1.18 is the tightest margin: it **governs**.
- Assumptions to test: no shock loads; shaft deflection and the key not yet checked; adequate lubrication.

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