A non-communicating calculator is allowed. Full credit will only be given if all steps used are clearly communicated (free body diagrams, algebra, etc).

The bar shown in Figure 1 below has forces acting at various points on the right and one couple of magnitude $10N \cdot m$ acting on the left. Under this loading, the bar is in static equilbrium.

$$\Sigma M = 10N \cdot m$$
$$\Sigma F = 0$$
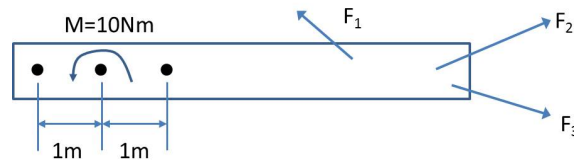for static equil.

M=10Nm

F₁

F₂

F₃

1m 1m

Figure 1: Bar in static equilibrium

For each of the following modified loads, will the bar still maintain static equilibrium? Briefly justify your answer for each case.

F=10N
M=20Nm
-10N·m
F₁
F₂
F₃
F=10N

$$\Sigma F = 0$$
$$\Sigma M = 10Nm$$
∴ static

(a)

F=10N
F₁
F₂
F₃

$$\Sigma F \neq 0$$
∴ not static

(b)

F=5N
10N·m
F₁
F₂
F₃
F=5N

$$\Sigma F = 0$$
$$\Sigma M = 10N \cdot m$$
∴ static

(c)

M=20Nm
F₁
F₂
F₃

$$\Sigma M \neq 10N \cdot m$$
∴ not static

(d)

F=5N
F₁
F₂
F₃
F=5N

$$\Sigma M \neq 10N \cdot m$$
∴ not static

(e)

M=15Nm
F₁
F₂
F₃
F=10N

$$\Sigma F \neq 0$$
∴ not static

(f)