Problem 3 — Continual Learning (CL) Cheat Sheet

Key Challenge: Catastrophic Forgetting in sequential tasks.

Main Approaches:

1. Replay — small exemplar buffer or generative replay (best retention per memory).
2. Regularization — EWC (weight constraints), KD (distillation).
3. Architectural — adapters, progressive nets (avoid forgetting, but heavier).

Chosen Solution: Replay + KD + Online-EWC

• Replay stabilizes representations.
• KD preserves function behavior.
• Online-EWC constrains critical parameters cheaply.

Metrics:

1. Average Accuracy: across tasks after final training.
2. BWT (Backward Transfer): Δaccuracy on past tasks.
3. FWT (Forward Transfer): zero-shot gain on future tasks.
4. Footprint: memory buffer (MB), model size, latency.

Equations:

$BWT = (1/T-1)\ \Sigma\ [Acc_{T,i} - Acc_{i,i}],\ i=1..T-1$
$FWT = (1/T-1)\ \Sigma\ [Acc_{0,i} - Acc_{rand,i}],\ i=2..T$

Training Loop:

1. 1. Freeze teacher $f\theta^*$.
2. 2. Mix: 80% current + 20% replay.
3. 3. Loss = CE + λKD·KD + λEWC·EWC.
4. 4. Update buffer, refresh teacher, update Fisher importance.