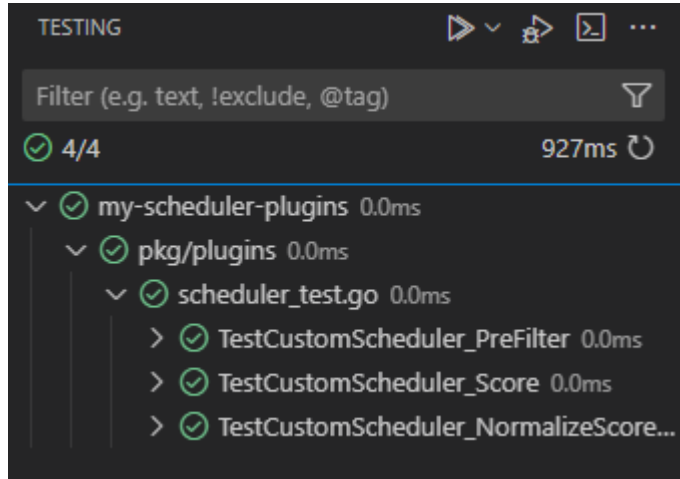


1. The screenshot of kubectl get nodes

```
henl@ubuntu:~/NTHU-Scheduler-Plugin$ kubectl get node -o wide
```

NAME	STATUS	ROLES	AGE	VERSION	INTERNAL-IP	EXTERNAL-IP	OS-IMAGE	KERNEL-VERSION	CONTAINER-RUNTIME
kind-control-plane	Ready	control-plane	18d	v1.29.2	172.18.0.4	<none>	Debian GNU/Linux 12 (bookworm)	5.15.0-107-generic	containerd://1.7.13
kind-worker	Ready	<none>	18d	v1.29.2	172.18.0.3	<none>	Debian GNU/Linux 12 (bookworm)	5.15.0-107-generic	containerd://1.7.13
kind-worker2	Ready	<none>	18d	v1.29.2	172.18.0.2	<none>	Debian GNU/Linux 12 (bookworm)	5.15.0-107-generic	containerd://1.7.13

2. The screenshot of passing all the unit tests



3. Explain

● Prefilter

- 2 個 deployment group ,
 - ◆ Group1 replica 設為 3 , minAvailable 設為 3
 - ◆ Group1 replica 設為 2 , minAvailable 設為 3
- Group1 剛 apply , 第一個 replica pod 因為沒到 minAvailable , 因此卡在 prefilter

```
10616 09:20:53.148471 1 log.go:194] Pod nginx-deployment-group-a-58b7fd46d9-5fqbk is in Prefilter phase.
10616 09:20:53.148494 1 log.go:194] The number of pods: 1 doesn't match min available: 3
10616 09:20:53.148571 1 schedule_one.go:867] "Unable to schedule pod; no fit; waiting" pod="default/nginx-deployment-group-a-58b7fd46d9-5fqbk" err="0/3 nodes are available: preemption: 0/3 nodes are available: 3 No preemption victims found for incoming pod.."
```

而其餘兩個應該是同時被創建，因此剛好符合 minAvailable，因此通過 prefilter

```
10616 09:20:53.161369 1 log.go:194] Pod nginx-deployment-group-a-58b7fd46d9-7qs9j is in Prefilter phase.
10616 09:20:53.161386 1 log.go:194] Pod is successfully pre-filtered
```

```
10616 09:20:53.160920 1 log.go:194] Pod nginx-deployment-group-a-58b7fd46d9-bzhx8 is in Prefilter phase.
10616 09:20:53.160951 1 log.go:194] Pod is successfully pre-filtered
```

- Group2 因為最多就 2 個 replica pod，而 minAvailable 設為 3，因此不管怎樣都不會過

```
10616 09:20:53.161689 1 log.go:194] Pod nginx-deployment-group-b-d6c99cc98-zzmpx is in Prefilter phase.
10616 09:20:53.161703 1 log.go:194] The number of pods: 2 doesn't match min available: 3
10616 09:20:53.161746 1 schedule_one.go:867] "Unable to schedule pod; no fit; waiting" pod="default/nginx-deployment-group-b-d6c99cc98-zzmpx" err="0/3 nodes are available: preemption: 0/3 nodes are available: 3 No preemption victims found for incoming pod.."
```

```
10616 09:20:53.156553 1 log.go:194] Pod nginx-deployment-group-b-d6c99cc98-ckbn4 is in Prefilter phase.
10616 09:20:53.156587 1 log.go:194] The number of pods: 1 doesn't match min available: 3
10616 09:20:53.156654 1 schedule_one.go:867] "Unable to schedule pod; no fit; waiting" pod="default/nginx-deployment-group-b-d6c99cc98-ckbn4" err="0/3 nodes are available: preemption: 0/3 nodes are available: 3 No preemption victims found for incoming pod.."
```

- Least mode

- 3 個所屬 Group A 的 pod，limits 和 requests 都設為 100Mi。kubectl 順序下去 create
- minAvailable 設為 3，因此第一次 schedule 只有第三個 pod 進入 score，也正確選擇 memory 較少的 node

```
I0616 09:27:56.686748 1 log.go:194] Pod nginx-3 is in Prefilter phase.
I0616 09:27:56.686817 1 log.go:194] Pod is successfully pre-filtered
I0616 09:27:56.686958 1 log.go:194] Pod nginx-3 is in Score phase. Calculate the score of Node kind-worker.
I0616 09:27:56.688147 1 log.go:194] Available memory: 3402072064 in node kind-worker
I0616 09:27:56.688524 1 log.go:194] Pod nginx-3 is in Score phase. Calculate the score of Node kind-worker2.
I0616 09:27:56.688584 1 log.go:194] Available memory: 3938942976 in node kind-worker2
I0616 09:27:56.688645 1 log.go:194] Node name: kind-worker, Score: 100
I0616 09:27:56.688720 1 log.go:194] Node name: kind-worker2, Score: 0
I0616 09:27:56.692936 1 schedule_one.go:252] "Successfully bound pod to node" pod="default/nginx-3" node="kind-worker" evaluatedNodes=3 feasibleNodes=2
```

- allocatable memory 我發現就算有 pod 在上面，數值都不會變。因此我有扣掉目前該 node 已被 requests 的 memory，以代表該 node 可能剩下的 memory

```
func (cs *CustomScheduler) Score(ctx context.Context, state *framework.CycleState, pod
    log.Printf("Pod %s is in Score phase. Calculate the score of Node %s.", pod.Name, n

    // TODO
    // 1. retrieve the node allocatable memory
    // 2. return the score based on the scheduler mode
    nodeInfo, _ := cs.handle.SnapshotSharedLister().NodeInfos().Get(nodeName)
    availableMem := nodeInfo.Allocatable.Memory - nodeInfo.Requested.Memory
    log.Printf("Available memory: %d in node %s", availableMem, nodeInfo.Node().Name)
    score := int64(0)
    if cs.scoreMode == leastMode {
        score = -availableMem
    } else if cs.scoreMode == mostMode {
        score = availableMem
    }

    return score, nil
}
```

- 由於 pod3 在 kind-worker node 上，因此 pod1 pod2 看到的數值就會更低，而其也正確地指派給 kind-worker

```
I0616 09:33:10.691603 1 log.go:194] Pod nginx-1 is in Prefilter phase.
I0616 09:33:10.691658 1 log.go:194] Pod is successfully pre-filtered
I0616 09:33:10.691910 1 log.go:194] Pod nginx-1 is in Score phase. Calculate the score of Node kind-worker.
I0616 09:33:10.691919 1 log.go:194] Available memory: 3297214464 in node kind-worker
I0616 09:33:10.691943 1 log.go:194] Pod nginx-1 is in Score phase. Calculate the score of Node kind-worker2.
I0616 09:33:10.691955 1 log.go:194] Available memory: 3938942976 in node kind-worker2
I0616 09:33:10.691990 1 log.go:194] Node name: kind-worker, Score: 100
I0616 09:33:10.692020 1 log.go:194] Node name: kind-worker2, Score: 0
```

```
I0616 09:33:10.698800 1 schedule_one.go:252] "Successfully bound pod to node" pod="default/nginx-1" node="kind-worker" evaluatedNodes=3 feasibleNodes=2
```

```
I0616 09:33:10.692120 1 log.go:194] Pod nginx-2 is in Prefilter phase.
I0616 09:33:10.692157 1 log.go:194] Pod is successfully pre-filtered
I0616 09:33:10.692248 1 log.go:194] Pod nginx-2 is in Score phase. Calculate the score of Node kind-worker.
I0616 09:33:10.692275 1 log.go:194] Available memory: 3192356864 in node kind-worker
I0616 09:33:10.692289 1 log.go:194] Pod nginx-2 is in Score phase. Calculate the score of Node kind-worker2.
I0616 09:33:10.692318 1 log.go:194] Available memory: 3938942976 in node kind-worker2
I0616 09:33:10.692449 1 log.go:194] Node name: kind-worker, Score: 100
I0616 09:33:10.692456 1 log.go:194] Node name: kind-worker2, Score: 0
I0616 09:33:10.697022 1 schedule_one.go:252] "Successfully bound pod to node" pod="default/nginx-2" node="kind-worker" evaluatedNodes=3 feasibleNodes=2
```

- Most mode
 - 3 個所屬 Group A 的 pod，其 limits 和 requests 為下所示。kubectl 順序下去 create
 - ◆ Pod1 (requests / limits): 100Mi / 100Mi
 - ◆ Pod2 (requests / limits): 100Mi / 100Mi
 - ◆ Pod3 (requests / limits): 600Mi / 600Mi
 - minAvailable 設為 3，因此第一次 schedule 只有第三個 pod 進入 score，也正確選擇 memory 較多的 node

```

10616 09:39:45.192305 1 log.go:194] Pod nginx-3 is in Prefilter phase.
10616 09:39:45.192334 1 log.go:194] Pod is successfully pre-filtered
10616 09:39:45.192458 1 log.go:194] Pod nginx-3 is in Score phase. Calculate the score of Node kind-worker.
10616 09:39:45.192470 1 log.go:194] Available memory: 3402072064 in node kind-worker
10616 09:39:45.192476 1 log.go:194] Pod nginx-3 is in Score phase. Calculate the score of Node kind-worker2.
10616 09:39:45.192480 1 log.go:194] Available memory: 33938942976 in node kind-worker2
10616 09:39:45.192504 1 log.go:194] Node name: kind-worker, Score: 0
10616 09:39:45.192508 1 log.go:194] Node name: kind-worker2, Score: 100
10616 09:39:45.198427 1 schedule_one.go:252] "Successfully bound pod to node" pod="default/nginx-3" node="kind-worker2" evaluatedNodes=3 feasibleNodes=2

```

- 與前面提及一樣，allocatable memory 會扣掉該 node 已被 requested 的量
- 經過 pod3 deploy，現在是 kind-worker memory 比較多，因此 pod1 選擇 kind-worker

```

10616 09:45:13.634093 1 log.go:194] Pod nginx-1 is in Prefilter phase.
10616 09:45:13.634147 1 log.go:194] Pod is successfully pre-filtered
10616 09:45:13.634317 1 log.go:194] Pod nginx-1 is in Score phase. Calculate the score of Node kind-worker.
10616 09:45:13.634361 1 log.go:194] Available memory: 3402072064 in node kind-worker
10616 09:45:13.634377 1 log.go:194] Pod nginx-1 is in Score phase. Calculate the score of Node kind-worker2.
10616 09:45:13.634383 1 log.go:194] Available memory: 3309797376 in node kind-worker2
10616 09:45:13.634421 1 log.go:194] Node name: kind-worker, Score: 100
10616 09:45:13.634428 1 log.go:194] Node name: kind-worker2, Score: 0

```

```

10616 09:45:13.638950 1 schedule_one.go:252] "Successfully bound pod to node" pod="default/nginx-1" node="kind-worker" evaluatedNodes=3 feasibleNodes=2

```

- 而經過 pod1 deploy，又變回 kind-worker2 memory 比較多，因此 pod2 選擇 kind-worker2

```

10616 09:45:13.634506 1 log.go:194] Pod nginx-2 is in Prefilter phase.
10616 09:45:13.634548 1 log.go:194] Pod is successfully pre-filtered
10616 09:45:13.634973 1 log.go:194] Pod nginx-2 is in Score phase. Calculate the score of Node kind-worker.
10616 09:45:13.635009 1 log.go:194] Available memory: 3297214464 in node kind-worker
10616 09:45:13.635023 1 log.go:194] Pod nginx-2 is in Score phase. Calculate the score of Node kind-worker2.
10616 09:45:13.635029 1 log.go:194] Available memory: 3309797376 in node kind-worker2
10616 09:45:13.635056 1 log.go:194] Node name: kind-worker, Score: 0
10616 09:45:13.635062 1 log.go:194] Node name: kind-worker2, Score: 100

```

```

10616 09:45:13.640690 1 schedule_one.go:252] "Successfully bound pod to node" pod="default/nginx-2" node="kind-worker2" evaluatedNodes=3 feasibleNodes=2

```