Kubectl get nodes:

```
student@ds-student14:~/NTHU-Scheduler-Plugin$ kubectl get nodes
NAME                STATUS   ROLES           AGE   VERSION
kind-control-plane  Ready    control-plane   16d   v1.29.2
kind-worker         Ready    <none>          16d   v1.29.2
kind-worker2        Ready    <none>          16d   v1.29.2
```

Unit tests:

```
?       my-scheduler-plugins/cmd/scheduler       [no test files]
=== RUN   TestCustomScheduler_PreFilter
=== RUN   TestCustomScheduler_PreFilter/pod_is_accepted
finish adding2024/06/14 08:36:29 Pod  is in Prefilter phase.
=== RUN   TestCustomScheduler_PreFilter/pod_is_just_accepted
finish adding2024/06/14 08:36:29 Pod  is in Prefilter phase.
=== RUN   TestCustomScheduler_PreFilter/pod_is_rejected
finish adding2024/06/14 08:36:29 Pod  is in Prefilter phase.
--- PASS: TestCustomScheduler_PreFilter (0.00s)
    --- PASS: TestCustomScheduler_PreFilter/pod_is_accepted (0.00s)
    --- PASS: TestCustomScheduler_PreFilter/pod_is_just_accepted (0.00s)
    --- PASS: TestCustomScheduler_PreFilter/pod_is_rejected (0.00s)
=== RUN   TestCustomScheduler_Score
=== RUN   TestCustomScheduler_Score/least_mode
2024/06/14 08:36:29 Custom scheduler runs with the mode: Least.
2024/06/14 08:36:29 Pod  is in Score phase. Calculate the score of Node m1.
2024/06/14 08:36:29 Node m1's score: -100
2024/06/14 08:36:29 Pod  is in Score phase. Calculate the score of Node m2.
2024/06/14 08:36:29 Node m2's score: -200
=== RUN   TestCustomScheduler_Score/most_mode
2024/06/14 08:36:29 Custom scheduler runs with the mode: Least.
2024/06/14 08:36:29 Pod  is in Score phase. Calculate the score of Node m1.
2024/06/14 08:36:29 Node m1's score: 100
2024/06/14 08:36:29 Pod  is in Score phase. Calculate the score of Node m2.
2024/06/14 08:36:29 Node m2's score: 200
--- PASS: TestCustomScheduler_Score (0.00s)
    --- PASS: TestCustomScheduler_Score/least_mode (0.00s)
    --- PASS: TestCustomScheduler_Score/most_mode (0.00s)
=== RUN   TestCustomScheduler_NormalizeScore
=== RUN   TestCustomScheduler_NormalizeScore/scores_in_range
=== RUN   TestCustomScheduler_NormalizeScore/scores_out_of_range
=== RUN   TestCustomScheduler_NormalizeScore/negative_score
--- PASS: TestCustomScheduler_NormalizeScore (0.00s)
    --- PASS: TestCustomScheduler_NormalizeScore/scores_in_range (0.00s)
    --- PASS: TestCustomScheduler_NormalizeScore/scores_out_of_range (0.00s)
    --- PASS: TestCustomScheduler_NormalizeScore/negative_score (0.00s)
PASS
ok      my-scheduler-plugins/pkg/plugins         0.036s
```

Scenarios

Spec1: 測試 prefilter

```
apiVersion: v1                  apiVersion: v1                  apiVersion: v1                  apiVersion: v1
kind: Pod                       kind: Pod                       kind: Pod                       kind: Pod
metadata:                       metadata:                       metadata:                       metadata:
  name: nginxa1                   name: nginxa2                   name: nginxa3                   name: nginxb1
  labels:                         labels:                         labels:                         labels:
    podGroup: "A"                   podGroup: "A"                   podGroup: "A"                   podGroup: "B"
    minAvailable: "3"               minAvailable: "3"               minAvailable: "3"               minAvailable: "3"
spec:                           spec:                           spec:                           spec:
  schedulerName: my-scheduler     schedulerName: my-scheduler     schedulerName: my-scheduler     schedulerName: my-scheduler
  containers:                     containers:                     containers:                     containers:
  - name: nginx                   - name: nginx                   - name: nginx                   - name: nginx
    image: nginx:1.14.2             image: nginx:1.14.2             image: nginx:1.14.2             image: nginx:1.14.2
    ports:                          ports:                          ports:                          ports:
    - containerPort: 80             - containerPort: 80             - containerPort: 80             - containerPort: 80
    resources:                      resources:                      resources:                      resources:
      requests:                       requests:                       requests:                       requests:
        memory: "100Mi"                 memory: "100Mi"                 memory: "100Mi"                 memory: "100Mi"
      limits:                         limits:                         limits:                         limits:
        memory: "100Mi"                 memory: "100Mi"                 memory: "100Mi"                 memory: "100Mi"
---
```

裡面有四個 pods,每個都是設 minAvailable 為 3,故 nginxa1, nginxa2 會沒辦法分配:

```
I0614 09:19:54.594294       1 log.go:194] Pod nginxa1 is in Prefilter phase.
I0614 09:19:54.595106       1 schedule_one.go:867] "Unable to schedule pod; no fit; waiting" pod="default/nginxa1" err="0/3 nodes are available: Not enough pods in the group. pree
mption: 0/3 nodes are available: 3 No preemption victims found for incoming pod.."
I0614 09:19:54.643178       1 log.go:194] Pod nginxa2 is in Prefilter phase.
I0614 09:19:54.643628       1 schedule_one.go:867] "Unable to schedule pod; no fit; waiting" pod="default/nginxa2" err="0/3 nodes are available: Not enough pods in the group. pree
mption: 0/3 nodes are available: 3 No preemption victims found for incoming pod.."
```

而 nginxa3 可以分配,因為 podGroup 為 A 的已經有三個 pod 了:

```
I0614 09:19:54.690744       1 log.go:194] Pod nginxa3 is in Prefilter phase.
I0614 09:19:54.691583       1 log.go:194] Pod nginxa3 is in Score phase. Calculate the score of Node kind-worker.
I0614 09:19:54.691614       1 log.go:194] Node kind-worker's remaining memory: 1293252KB, score: 1324290048
I0614 09:19:54.691665       1 log.go:194] Pod nginxa3 is in Score phase. Calculate the score of Node kind-worker2.
I0614 09:19:54.691678       1 log.go:194] Node kind-worker2's remaining memory: 1817540KB, score: 1861160960
I0614 09:19:54.697447       1 schedule_one.go:252] "Successfully bound pod to node" pod="default/nginxa3" node="kind-worker2" evaluatedNodes=3 feasibleNodes=2
```

最後 nginxb1 沒辦法分配,因為 podGroup 為 B 的數量沒超過 minAvailable:

```
I0614 09:19:54.737665       1 log.go:194] Pod nginxb1 is in Prefilter phase.
I0614 09:19:54.738035       1 schedule_one.go:867] "Unable to schedule pod; no fit; waiting" pod="default/nginxb1" err="0/3 nodes are available: Not enough pods in the group. pree
mption: 0/3 nodes are available: 3 No preemption victims found for incoming pod.."
```

最後結果:

```
my-scheduler-69cfc986c7-wrb94    1/1    Running    0    9m22s
nginxa1                          0/1    Pending    0    12s
nginxa2                          0/1    Pending    0    12s
nginxa3                          1/1    Running    0    12s
nginxb1                          0/1    Pending    0    12s
```

Spec2: 測試 Most mode

用 grep 中在 log 中可以看到現在的 mode 是 Most:

```
I0614 09:44:23.425989       1 log.go:194] Custom scheduler runs with the mode: Most.
            mode: Most
```

再來創建 pods:

```
apiVersion: v1                 apiVersion: v1                 apiVersion: v1
kind: Pod                      kind: Pod                      kind: Pod
metadata:                      metadata:                      metadata:
  name: nginxa4                  name: nginxa5                  name: nginxa6
  labels:                        labels:                        labels:
    podGroup: "A"                  podGroup: "A"                  podGroup: "A"
    minAvailable: "1"              minAvailable: "1"              minAvailable: "1"
spec:                          spec:                          spec:
  schedulerName: my-scheduler    schedulerName: my-scheduler    schedulerName: my-scheduler
  containers:                    containers:                    containers:
  - name: nginx                  - name: nginx                  - name: nginx
    image: nginx:1.14.2            image: nginx:1.14.2            image: nginx:1.14.2
    ports:                         ports:                         ports:
    - containerPort: 80            - containerPort: 80            - containerPort: 80
    resources:                     resources:                     resources:
      requests:                      requests:                      requests:
        memory: "1000Mi"               memory: "500Mi"                memory: "500Mi"
      limits:                        limits:                        limits:
        memory: "1000Mi"               memory: "500Mi"                memory: "500Mi"
```

Nginxa4 計算分數時，kind-worker2 剩餘 memory 比較多，即分數比較高，故會被分配到 kind-worker2

```
I0614 09:45:01.525584       1 log.go:194] Pod nginxa4 is in Prefilter phase.
I0614 09:45:01.526469       1 log.go:194] Pod nginxa4 is in Score phase. Calculate the score of Node kind-worker.
I0614 09:45:01.526499       1 log.go:194] Node kind-worker's remaining memory: 1293252KB, score: 1324290048
I0614 09:45:01.526528       1 log.go:194] Pod nginxa4 is in Score phase. Calculate the score of Node kind-worker2.
I0614 09:45:01.526537       1 log.go:194] Node kind-worker2's remaining memory: 1817540KB, score: 1861160960
I0614 09:45:01.533496       1 schedule_one.go:252] "Successfully bound pod to node" pod="default/nginxa4" node="kind-worker2" evaluatedNodes=3
 feasibleNodes=2
```

接著 Nginxa5 計算分數時，kind-worker 剩餘 memory 比較多分數比較高，故會被分配到 kind-worker

```
I0614 09:45:01.570744       1 log.go:194] Pod nginxa5 is in Prefilter phase.
I0614 09:45:01.571274       1 log.go:194] Pod nginxa5 is in Score phase. Calculate the score of Node kind-worker.
I0614 09:45:01.571345       1 log.go:194] Node kind-worker's remaining memory: 1293252KB, score: 1324290048
I0614 09:45:01.571367       1 log.go:194] Pod nginxa5 is in Score phase. Calculate the score of Node kind-worker2.
I0614 09:45:01.571374       1 log.go:194] Node kind-worker2's remaining memory: 793540KB, score: 812584960
I0614 09:45:01.579158       1 schedule_one.go:252] "Successfully bound pod to node" pod="default/nginxa5" node="kind-worker" evaluatedNodes=3
feasibleNodes=2
```

接著 Nginxa6 計算分數時，kind-worker2 剩餘 memory 比較多分數比較高，故會被分配到 kind-worker2

```
I0614 09:45:01.616383       1 log.go:194] Pod nginxa6 is in Prefilter phase.
I0614 09:45:01.616746       1 log.go:194] Pod nginxa6 is in Score phase. Calculate the score of Node kind-worker.
I0614 09:45:01.616793       1 log.go:194] Node kind-worker's remaining memory: 781252KB, score: 800002048
I0614 09:45:01.616812       1 log.go:194] Pod nginxa6 is in Score phase. Calculate the score of Node kind-worker2.
I0614 09:45:01.616822       1 log.go:194] Node kind-worker2's remaining memory: 793540KB, score: 812584960
I0614 09:45:01.621449       1 schedule_one.go:252] "Successfully bound pod to node" pod="default/nginxa6" node="kind-worker2" evaluatedNodes=3
 feasibleNodes=2
```

分配結果:

```
NAME                          READY   STATUS    RESTARTS   AGE   IP            NODE           NOMINATED NODE   READINESS GATES
my-scheduler-69cfc986c7-7kxfp 1/1     Running   0          25s   10.244.1.29   kind-worker2   <none>          <none>
nginxa4                       1/1     Running   0          8s    10.244.1.30   kind-worker2   <none>          <none>
nginxa5                       1/1     Running   0          8s    10.244.2.36   kind-worker    <none>          <none>
nginxa6                       1/1     Running   0          8s    10.244.1.31   kind-worker2   <none>          <none>
```

Spec3: 測試 least mode

```
I0614 09:36:19.142950        1 log.go:194] Custom scheduler runs with the mode: Least.
              mode: Least
```

Pod Spec:

```
apiVersion: v1
kind: Pod
metadata:
  name: nginxa7
  labels:
    podGroup: "A"
    minAvailable: "1"
spec:
  schedulerName: my-scheduler
  containers:
  - name: nginx
    image: nginx:1.14.2
    ports:
    - containerPort: 80
    resources:
      requests:
        memory: "500Mi"
      limits:
        memory: "500Mi"
```

```
apiVersion: v1
kind: Pod
metadata:
  name: nginxa8
  labels:
    podGroup: "A"
    minAvailable: "1"
spec:
  schedulerName: my-scheduler
  containers:
  - name: nginx
    image: nginx:1.14.2
    ports:
    - containerPort: 80
    resources:
      requests:
        memory: "100Mi"
      limits:
        memory: "100Mi"
```

```
apiVersion: v1
kind: Pod
metadata:
  name: nginxa9
  labels:
    podGroup: "A"
    minAvailable: "1"
spec:
  schedulerName: my-scheduler
  containers:
  - name: nginx
    image: nginx:1.14.2
    ports:
    - containerPort: 80
    resources:
      requests:
        memory: "100Mi"
      limits:
        memory: "100Mi"
```

Nginxa7 計算分數時，**kind-worker** 剩餘 **memory** 比較少，即分數比較高，故會被分配到 **kind-worker**

```
I0614 10:04:12.728831        1 log.go:194] Pod nginxa7 is in Prefilter phase.
I0614 10:04:12.729842        1 log.go:194] Pod nginxa7 is in Score phase. Calculate the score of Node kind-worker.
I0614 10:04:12.729865        1 log.go:194] Node kind-worker's remaining memory: 1293252KB, score: -1324290048
I0614 10:04:12.729873        1 log.go:194] Pod nginxa7 is in Score phase. Calculate the score of Node kind-worker2.
I0614 10:04:12.729877        1 log.go:194] Node kind-worker2's remaining memory: 1817540KB, score: -1861160960
I0614 10:04:12.736121        1 schedule_one.go:252] "Successfully bound pod to node" pod="default/nginxa7" node="kind-worker" evaluatedNodes=3
feasibleNodes=2
```

接著 **Nginxa8** 計算分數時，**kind-worker** 剩餘 **memory** 比較少分數比較高，故會被分配到 **kind-worker**

```
I0614 10:04:12.781366        1 log.go:194] Pod nginxa8 is in Prefilter phase.
I0614 10:04:12.781728        1 log.go:194] Pod nginxa8 is in Score phase. Calculate the score of Node kind-worker.
I0614 10:04:12.781749        1 log.go:194] Node kind-worker's remaining memory: 781252KB, score: -800002048
I0614 10:04:12.781758        1 log.go:194] Pod nginxa8 is in Score phase. Calculate the score of Node kind-worker2.
I0614 10:04:12.781762        1 log.go:194] Node kind-worker2's remaining memory: 1817540KB, score: -1861160960
I0614 10:04:12.787825        1 schedule_one.go:252] "Successfully bound pod to node" pod="default/nginxa8" node="kind-worker" evaluatedNodes=3
feasibleNodes=2
```

接著 **Nginxa9** 計算分數時，**kind-worker** 剩餘 **memory** 比較少分數比較高，故會被分配到 **kind-worker**

```
I0614 10:04:12.834523        1 log.go:194] Pod nginxa9 is in Prefilter phase.
I0614 10:04:12.835421        1 log.go:194] Pod nginxa9 is in Score phase. Calculate the score of Node kind-worker2.
I0614 10:04:12.835449        1 log.go:194] Node kind-worker2's remaining memory: 1817540KB, score: -1861160960
I0614 10:04:12.835465        1 log.go:194] Pod nginxa9 is in Score phase. Calculate the score of Node kind-worker.
I0614 10:04:12.835473        1 log.go:194] Node kind-worker's remaining memory: 678852KB, score: -695144448
I0614 10:04:12.841182        1 schedule_one.go:252] "Successfully bound pod to node" pod="default/nginxa9" node="kind-worker" evaluatedNodes=3
feasibleNodes=2
```

分配結果**:**

```
NAME                            READY  STATUS   RESTARTS  AGE  IP           NODE          NOMINATED NODE  READINESS GATES
my-scheduler-69cfc986c7-n2l4j   1/1    Running  0         22s  10.244.1.32  kind-worker2  <none>          <none>
nginxa7                         1/1    Running  0         13s  10.244.2.38  kind-worker   <none>          <none>
nginxa8                         1/1    Running  0         13s  10.244.2.39  kind-worker   <none>          <none>
nginxa9                         1/1    Running  0         13s  10.244.2.40  kind-worker   <none>          <none>
```