

k8s report

The screenshot of kubectl get nodes

```
● student@ds-student12:~/NTHU-Scheduler-Plugin$ kubectl get nodes
NAME                STATUS    ROLES    AGE   VERSION
kind-control-plane  Ready    control-plane  7d5h  v1.29.2
kind-worker          Ready    <none>       7d5h  v1.29.2
kind-worker2         Ready    <none>       7d5h  v1.29.2
```

The screenshot of passing all the unit tests

```
root@87b2c296fd0b:/go/src/app# go test -v ./...
?      my-scheduler-plugins/cmd/scheduler      [no test files]
=== RUN   TestCustomScheduler_PreFilter
=== RUN   TestCustomScheduler_PreFilter/pod_is_accepted
finish adding2024/05/28 14:36:58 Pod  is in Prefilter phase.
=== RUN   TestCustomScheduler_PreFilter/pod_is_just_accepted
finish adding2024/05/28 14:36:58 Pod  is in Prefilter phase.
=== RUN   TestCustomScheduler_PreFilter/pod_is_rejected
finish adding2024/05/28 14:36:58 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
2024/05/28 14:36:58 Custom scheduler runs with the mode: Least.
2024/05/28 14:36:58 Pod  is in Score phase. Calculate the score of Node m1.
2024/05/28 14:36:58 Pod  score is 0.
2024/05/28 14:36:58 Pod  is in Score phase. Calculate the score of Node m2.
2024/05/28 14:36:58 Pod  score is 0.
=== RUN   TestCustomScheduler_Score/most_mode
2024/05/28 14:36:58 Custom scheduler runs with the mode: Least.
2024/05/28 14:36:58 Pod  is in Score phase. Calculate the score of Node m1.
2024/05/28 14:36:58 Pod  score is 100.
2024/05/28 14:36:58 Pod  is in Score phase. Calculate the score of Node m2.
2024/05/28 14:36:58 Pod  score is 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      0.030s
root@87b2c296fd0b:/go/src/app#
```

3 scenarios

scenario 1

2個Pod(nginx、nginx-2)

nginx : podGroup: "A"、minAvailable: "1"、request memory: "100Mi"、limits memory: "100Mi"

nginx-2 : podGroup: "B"、minAvailable: "1"、request memory: "100Mi"、limits memory: "100Mi"

- Most Mode

因為兩個Pod所在的Group的minAvailable都是1，都會直接被schedule，這邊是用Most Mode，會將Pod分配給可分配的memory空間較大的node，都是kind-worker2。

```
student@ds-student12:~/NTHU-Scheduler-Plugin$ kubectl get po -o wide
NAME                                READY   STATUS    RESTARTS   AGE   IP              NODE             NOMINATED NODE   READINESS GATES
my-scheduler-69cfc986c7-76sxx      1/1     Running   0           13s   10.244.2.19     kind-worker2     <none>           <none>
nginx                                1/1     Running   0           2s    10.244.2.20     kind-worker2     <none>           <none>
nginx-2                             1/1     Running   0           2s    10.244.2.21     kind-worker2     <none>           <none>
```

scheduler nginx log

```
I0605 15:58:24.774170 1 log.go:194] Pod nginx is in Prefilter phase.
I0605 15:58:24.774199 1 log.go:194] groupLabel: A
I0605 15:58:24.774203 1 log.go:194] minAvailable: 1
I0605 15:58:24.774555 1 log.go:194] Pod nginx is in Score phase. Calculate the score of Node kind-worker.
I0605 15:58:24.774571 1 log.go:194] original allocatableMemory = 1376718848
I0605 15:58:24.774575 1 log.go:194] node kind-worker has been requested memory = 52428800
I0605 15:58:24.774579 1 log.go:194] score Mode: Most
I0605 15:58:24.774586 1 log.go:194] node kind-worker now can be allocated memory: 1324290048
I0605 15:58:24.774589 1 log.go:194] Node kind-worker score is 1324290048.
I0605 15:58:24.774593 1 log.go:194]
I0605 15:58:24.774600 1 log.go:194] Pod nginx is in Score phase. Calculate the score of Node kind-worker2.
I0605 15:58:24.774608 1 log.go:194] original allocatableMemory = 1913589760
I0605 15:58:24.774612 1 log.go:194] node kind-worker2 has been requested memory = 52428800
I0605 15:58:24.774615 1 log.go:194] score Mode: Most
I0605 15:58:24.774618 1 log.go:194] node kind-worker2 now can be allocated memory: 1861160960
I0605 15:58:24.774622 1 log.go:194] Node kind-worker2 score is 1861160960.
I0605 15:58:24.774625 1 log.go:194]
I0605 15:58:24.782089 1 schedule_one.go:252] "Successfully bound pod to node" pod="default/nginx" node="kind-worker2" evaluatedNodes=3 feasibleNodes=2
```

scheduler nginx-2 log

```
I0605 15:58:24.820172 1 log.go:194] Pod nginx-2 is in Prefilter phase.
I0605 15:58:24.820204 1 log.go:194] groupLabel: B
I0605 15:58:24.820209 1 log.go:194] minAvailable: 1
I0605 15:58:24.820451 1 log.go:194] Pod nginx-2 is in Score phase. Calculate the score of Node kind-worker.
I0605 15:58:24.820567 1 log.go:194] original allocatableMemory = 1376718848
I0605 15:58:24.820598 1 log.go:194] node kind-worker has been requested memory = 52428800
I0605 15:58:24.820611 1 log.go:194] Pod nginx-2 is in Score phase. Calculate the score of Node kind-worker2.
I0605 15:58:24.820623 1 log.go:194] original allocatableMemory = 1913589760
I0605 15:58:24.820627 1 log.go:194] node kind-worker2 has been requested memory = 157286400
I0605 15:58:24.820631 1 log.go:194] score Mode: Most
I0605 15:58:24.820635 1 log.go:194] node kind-worker2 now can be allocated memory: 1756303360
I0605 15:58:24.820639 1 log.go:194] Node kind-worker2 score is 1756303360.
I0605 15:58:24.820642 1 log.go:194]
I0605 15:58:24.820663 1 log.go:194] score Mode: Most
I0605 15:58:24.820668 1 log.go:194] node kind-worker now can be allocated memory: 1324290048
I0605 15:58:24.820672 1 log.go:194] Node kind-worker score is 1324290048.
I0605 15:58:24.820675 1 log.go:194]
I0605 15:58:24.824762 1 schedule_one.go:252] "Successfully bound pod to node" pod="default/nginx-2" node="kind-worker2" evaluatedNodes=3 feasibleNodes=2
```

- Least Mode

因為兩個Pod所在的Group的minAvailable都是1，都會直接被schedule，這邊是用Least Mode，會將Pod分配給可分配的memory空間較小的node，都是kind-worker。

```
student@ds-student12:~/NTHU-Scheduler-Plugin$ kubectl get po -o wide
NAME                                READY   STATUS    RESTARTS   AGE   IP              NODE             NOMINATED NODE   READINESS GATES
my-scheduler-69cfc986c7-6n2tf      1/1     Running   0           22m   10.244.1.8      kind-worker      <none>           <none>
nginx                                1/1     Running   0           67s   10.244.1.9      kind-worker      <none>           <none>
nginx-2                             1/1     Running   0           67s   10.244.1.10     kind-worker      <none>           <none>
```

scheduler nginx log

```
I0605 15:47:37.296179 1 log.go:194] Pod nginx is in Prefilter phase.
I0605 15:47:37.296243 1 log.go:194] groupLabel: A
I0605 15:47:37.296249 1 log.go:194] minAvailable: 1
I0605 15:47:37.297216 1 log.go:194] Pod nginx is in Score phase. Calculate the score of Node kind-worker.
I0605 15:47:37.297243 1 log.go:194] original allocatableMemory = 1376718848
I0605 15:47:37.297256 1 log.go:194] node kind-worker has been requested memory = 52428800
I0605 15:47:37.297263 1 log.go:194] score Mode: Least
I0605 15:47:37.297268 1 log.go:194] now allocatableMemory: 1324290048
I0605 15:47:37.297280 1 log.go:194] Node kind-worker score is 75.
I0605 15:47:37.297289 1 log.go:194]
I0605 15:47:37.297367 1 log.go:194] Pod nginx is in Score phase. Calculate the score of Node kind-worker2.
I0605 15:47:37.297380 1 log.go:194] original allocatableMemory = 1913589760
I0605 15:47:37.297384 1 log.go:194] node kind-worker2 has been requested memory = 52428800
I0605 15:47:37.297387 1 log.go:194] score Mode: Least
I0605 15:47:37.297391 1 log.go:194] now allocatableMemory: 1861160960
I0605 15:47:37.297395 1 log.go:194] Node kind-worker2 score is 53.
I0605 15:47:37.297399 1 log.go:194]
I0605 15:47:37.303722 1 schedule_one.go:252] "Successfully bound pod to node" pod="default/nginx" node="kind-worker" evaluatedNodes=3 feasibleNodes=2
```

scheduler nginx-2 log

```
I0605 15:47:37.346169 1 log.go:194] Pod nginx-2 is in Prefilter phase.
I0605 15:47:37.346422 1 log.go:194] groupLabel: B
I0605 15:47:37.346506 1 log.go:194] minAvailable: 1
I0605 15:47:37.346884 1 log.go:194] Pod nginx-2 is in Score phase. Calculate the score of Node kind-worker.
I0605 15:47:37.346906 1 log.go:194] original allocatableMemory = 1376718848
I0605 15:47:37.346912 1 log.go:194] node kind-worker has been requested memory = 157286400
I0605 15:47:37.346918 1 log.go:194] score Mode: Least
I0605 15:47:37.346923 1 log.go:194] now allocatableMemory: 1219432448
I0605 15:47:37.346929 1 log.go:194] Node kind-worker score is 82.
I0605 15:47:37.346933 1 log.go:194]
I0605 15:47:37.346946 1 log.go:194] Pod nginx-2 is in Score phase. Calculate the score of Node kind-worker2.
I0605 15:47:37.346957 1 log.go:194] original allocatableMemory = 1913589760
I0605 15:47:37.346962 1 log.go:194] node kind-worker2 has been requested memory = 52428800
I0605 15:47:37.346967 1 log.go:194] score Mode: Least
I0605 15:47:37.346977 1 log.go:194] now allocatableMemory: 1861160960
I0605 15:47:37.346982 1 log.go:194] Node kind-worker2 score is 53.
I0605 15:47:37.346990 1 log.go:194]
I0605 15:47:37.350637 1 schedule_one.go:252] "Successfully bound pod to node" pod="default/nginx-2" node="kind-worker" evaluatedNodes=3 feasibleNodes=2
```

scenario 2

3個pod(nginx、nginx-2、nginx-3)

nginx : podGroup: "A"、minAvailable: "2"、request memory: "1000Mi"、limits memory: "1000Mi"

nginx-2 : podGroup: "A"、minAvailable: "2"、request memory: "1000Mi"、limits memory: "1000Mi"

nginx-3 : podGroup: "A"、minAvailable: "2"、request memory: "1000Mi"、limits memory: "1000Mi"

• Most mode

可以看到當第一個pod nginx被建立時並不會被schedule，這是因為此時在`group A`還未達到`minAvailable = 2`的標準，接著pod nginx-2被建立了，這時候`group A`中有2個pod，達到`minAvailable = 2`的標準，因此pod nginx-2會馬上被schedule，因為這邊是採用Most mode，所以pod nginx-2會被分配給allocatable memory較大的node，也就是kind-worker2。最後pod nginx-3被建立，這時候`group A`中有3個pod，達到`minAvailable = 2`的標準，因此pod nginx-3會馬上被schedule，因為這邊是採用Most mode，所以pod nginx-3會被分配給allocatable memory較大的node，也就是kind-worker(剛剛kind-worker-2已經分配給nginx 1000Mi了，所以目前allocatable memory最大的是kind-worker)。

```
student@ds-student12:~/NTHU-Scheduler-Plugin$ kubectl get po -o wide
NAME                                READY   STATUS    RESTARTS   AGE   IP              NODE           NOMINATED NODE   READINESS GATES
my-scheduler-69cfc986c7-76sxx      1/1     Running   0           2m41s  10.244.2.19     kind-worker2    <none>            <none>
nginx                                0/1     Pending   0           5s     <none>          <none>          <none>            <none>
nginx-2                             1/1     Running   0           5s     10.244.2.22     kind-worker2    <none>            <none>
nginx-3                             1/1     Running   0           5s     10.244.1.11     kind-worker     <none>            <none>
```

從下圖可以發現每5分鐘會重新偵測還沒被schedule的pod能不能被schedule了，這邊pod nginx一直無法被schedule是因為node memory空間不夠了。

```
I0605 16:06:15.492477 1 log.go:194] Pod nginx is in Prefilter phase.
I0605 16:06:15.492523 1 log.go:194] groupLabel: A
I0605 16:06:15.492535 1 log.go:194] minAvailable: 2
I0605 16:06:15.493485 1 schedule_one.go:867] "Unable to schedule pod; no fit; waiting" pod="default/nginx" err="0/3 nodes are available: 1 node(s) had untolerated taint {node-role.kubernetes.io/control-plane: }, 2 Insufficient memory. preemption: 0/3 nodes are available: 1 Preemption is not helpful for scheduling, 2 No preemption victims found for incoming pod.."
I0605 16:11:15.498541 1 log.go:194] Pod nginx is in Prefilter phase.
I0605 16:11:15.498586 1 log.go:194] groupLabel: A
I0605 16:11:15.498595 1 log.go:194] minAvailable: 2
I0605 16:11:15.499374 1 schedule_one.go:867] "Unable to schedule pod; no fit; waiting" pod="default/nginx" err="0/3 nodes are available: 1 node(s) had untolerated taint {node-role.kubernetes.io/control-plane: }, 2 Insufficient memory. preemption: 0/3 nodes are available: 1 Preemption is not helpful for scheduling, 2 No preemption victims found for incoming pod.."
student@ds-student12:~/NTHU-Scheduler-Plugin$
```

• Least Mode

這邊過程大致和Most Mode一樣，但最後pod被分配到的node會不同，pod nginx-2會被分配到kind-worker，因為kind-worker能被allocate memory最小，在Least Mode會先被分配，而pod nginx-3會直接分配到kind-worker2，因為kind-worker分配給nginx-2後的memory空間已經小

於1000Mi。之後會再回去檢查pod nginx能不能被schedule，此時已經滿足minAvailable標準，但還是無法被schedule是因為所有node memory空間都不夠分配給他。

```
student@ds-student12:~/NTHU-Scheduler-Plugin$ kubectl get po -o wide
```

| NAME | READY | STATUS | RESTARTS | AGE | IP | NODE | NOMINATED NODE | READINESS GATE |
|-------------------------------|-------|---------|----------|-------|-------------|--------------|----------------|----------------|
| S | | | | | | | | |
| my-scheduler-69cfc986c7-6khq7 | 1/1 | Running | 0 | 17m | 10.244.2.13 | kind-worker2 | <none> | <none> |
| nginx | 0/1 | Pending | 0 | 9m45s | <none> | <none> | <none> | <none> |
| nginx-2 | 1/1 | Running | 0 | 9m45s | 10.244.1.7 | kind-worker | <none> | <none> |
| nginx-3 | 1/1 | Running | 0 | 9m45s | 10.244.2.17 | kind-worker2 | <none> | <none> |

scheduler nginx log(第一次還不能schedule)

```
I0605 07:41:53.224677 1 log.go:194] Pod nginx is in Prefilter phase.
I0605 07:41:53.224798 1 log.go:194] groupLabel: A
I0605 07:41:53.224807 1 log.go:194] minAvailable: 2
I0605 07:41:53.224975 1 log.go:194] pods is not available
I0605 07:41:53.225438 1 schedule_one.go:867] "Unable to schedule pod; no fit; waiting" pod="default/nginx" err="0/3 nodes are available: Pod cannot be scheduled because the group 'A' has only 1 pods, but needs 2. preemption: 0/3 nodes are available: 3 No preemption victims found for incoming pod.."
```

scheduler nginx log(第二次被檢查，但沒有node有足夠的空間分配給他)

```
I0605 07:46:59.589819 1 log.go:194] Pod nginx is in Prefilter phase.
I0605 07:46:59.589856 1 log.go:194] groupLabel: A
I0605 07:46:59.589860 1 log.go:194] minAvailable: 2
I0605 07:46:59.590508 1 schedule_one.go:867] "Unable to schedule pod; no fit; waiting" pod="default/nginx" err="0/3 nodes are available: 1 node(s) had untolerated taint {node-role.kubernetes.io/control-plane: }, 2 Insufficient memory. preemption: 0/3 nodes are available: 1 Preemption is not helpful for scheduling, 2 No preemption victims found for incoming pod.."
```

scheduler nginx-2 log

```
I0605 07:41:53.268016 1 log.go:194] Pod nginx-2 is in Prefilter phase.
I0605 07:41:53.268050 1 log.go:194] groupLabel: A
I0605 07:41:53.268056 1 log.go:194] minAvailable: 2
I0605 07:41:53.268673 1 log.go:194] Pod nginx-2 is in Score phase. Calculate the score of Node kind-worker.
I0605 07:41:53.268697 1 log.go:194] original allocatableMemory = 1376718848
I0605 07:41:53.268703 1 log.go:194] node kind-worker has been requested memory = 52428800
I0605 07:41:53.268735 1 log.go:194] score Mode: Least
I0605 07:41:53.268745 1 log.go:194] now allocatableMemory: 1324290048
I0605 07:41:53.268750 1 log.go:194] Node kind-worker score is 75.
I0605 07:41:53.268755 1 log.go:194]
I0605 07:41:53.268804 1 log.go:194] Pod nginx-2 is in Score phase. Calculate the score of Node kind-worker2.
I0605 07:41:53.268823 1 log.go:194] original allocatableMemory = 1913589760
I0605 07:41:53.268829 1 log.go:194] node kind-worker2 has been requested memory = 52428800
I0605 07:41:53.268834 1 log.go:194] score Mode: Least
I0605 07:41:53.268840 1 log.go:194] now allocatableMemory: 1861160960
I0605 07:41:53.268845 1 log.go:194] Node kind-worker2 score is 53.
I0605 07:41:53.268850 1 log.go:194]
I0605 07:41:53.272977 1 schedule_one.go:252] "Successfully bound pod to node" pod="default/nginx-2" node="kind-worker" evaluatedNodes=3 feasibleNodes=2
```

scheduler nginx-3 log

```
I0605 07:41:53.311370 1 log.go:194] Pod nginx-3 is in Prefilter phase.
I0605 07:41:53.311397 1 log.go:194] groupLabel: A
I0605 07:41:53.311402 1 log.go:194] minAvailable: 2
I0605 07:41:53.316346 1 schedule_one.go:252] "Successfully bound pod to node" pod="default/nginx-3" node="kind-worker2" evaluatedNodes=3 feasibleNodes=1
```

scenario 3

4個pod(nginx、nginx-2、nginx-3、nginx-4)

nginx : podGroup: "A"、minAvailable: "1"、request memory: "400Mi"、limits memory: "400Mi"

nginx-2 : podGroup: "B"、minAvailable: "2"、request memory: "100Mi"、limits memory: "100Mi"

nginx-3 : podGroup: "B"、minAvailable: "2"、request memory: "1000Mi"、limits memory: "1000Mi"

nginx-4 : podGroup: "B"、minAvailable: "2"、request memory: "100Mi"、limits memory: "100Mi"

• Most Mode

nginx的minAvailable=1，所以該Pod一開始被建立時就會被分配到node，這時候kind-worker2可分配的memory比較大，所以被分配給kind-worker2。

接著nginx-2被建立但未達到minAvailable標準，所以會先pending。

接著nginx-3被建立也達到minAvailable標準，這時候kind-worker2可分配的memory比較大，所以被分配給kind-worker2。

接著nginx-4被建立也達到minAvailable標準，這時候kind-worker可分配的memory比較大，所以被分配給kind-worker。

接著過5分鐘左右nginx-2再次被檢查能否被schedule，這時候該group已經滿足minAvailable了，所以會被分配給此時可分配的memory比較大的kind-worker。

```
student@ds-student12:~/NTHU-Scheduler-Plugin$ kubectl get po -o wide
NAME                                READY   STATUS    RESTARTS   AGE   IP              NODE             NOMINATED NODE   READINESS GATES
my-scheduler-69cfc986c7-dcp92      1/1     Running   0           9m22s  10.244.2.10     kind-worker2     <none>           <none>
nginx                               1/1     Running   0           8m36s  10.244.2.11     kind-worker2     <none>           <none>
nginx-2                             1/1     Running   0           8m36s  10.244.1.5      kind-worker      <none>           <none>
nginx-3                             1/1     Running   0           8m36s  10.244.2.12     kind-worker2     <none>           <none>
nginx-4                             1/1     Running   0           8m36s  10.244.1.4      kind-worker      <none>           <none>
```

scheduler nginx log

```
I0605 06:34:51.642549    1 log.go:194] Pod nginx is in Prefilter phase.
I0605 06:34:51.642593    1 log.go:194] groupLabel: A
I0605 06:34:51.642599    1 log.go:194] minAvailable: 1
I0605 06:34:51.643509    1 log.go:194] Pod nginx is in Score phase. Calculate the score of Node kind-worker.
I0605 06:34:51.643540    1 log.go:194] original allocatableMemory = 1376718848
I0605 06:34:51.643553    1 log.go:194] Pod kindnet-b4fsb Memory Resources Limit: 52428800
I0605 06:34:51.643563    1 log.go:194] Pod kube-proxy-mtwj7 Memory Resources Limit: 0
I0605 06:34:51.643570    1 log.go:194] node kind-worker has been requested memory = 52428800
I0605 06:34:51.643575    1 log.go:194] score Mode: Most
I0605 06:34:51.643585    1 log.go:194] now allocatableMemory: 1324290048
I0605 06:34:51.643599    1 log.go:194] Node kind-worker score is 1324290048.
I0605 06:34:51.643608    1 log.go:194]
I0605 06:34:51.643639    1 log.go:194] Pod nginx is in Score phase. Calculate the score of Node kind-worker2.
I0605 06:34:51.643651    1 log.go:194] original allocatableMemory = 1913589760
I0605 06:34:51.643657    1 log.go:194] Pod kube-proxy-q5d2k Memory Resources Limit: 0
I0605 06:34:51.643664    1 log.go:194] Pod kindnet-pz8kw Memory Resources Limit: 52428800
I0605 06:34:51.643675    1 log.go:194] Pod my-scheduler-69cfc986c7-dcp92 Memory Resources Limit: 0
I0605 06:34:51.643684    1 log.go:194] node kind-worker2 has been requested memory = 52428800
I0605 06:34:51.643688    1 log.go:194] score Mode: Most
I0605 06:34:51.643693    1 log.go:194] now allocatableMemory: 1861160960
I0605 06:34:51.643697    1 log.go:194] Node kind-worker2 score is 1861160960.
I0605 06:34:51.643701    1 log.go:194]
I0605 06:34:51.653027    1 schedule_one.go:252] "Successfully bound pod to node" pod="default/nginx" node="kind-worker2" evaluatedNodes=3 feasibleNodes=2
```

scheduler nginx-2 log

```
I0605 06:34:51.694836    1 log.go:194] Pod nginx-2 is in Prefilter phase.
I0605 06:34:51.694860    1 log.go:194] groupLabel: B
I0605 06:34:51.694864    1 log.go:194] minAvailable: 2
I0605 06:34:51.694899    1 log.go:194] pods is not available
I0605 06:34:51.695172    1 schedule_one.go:867] "Unable to schedule pod; no fit; waiting" pod="default/nginx-2" err="0/3 nodes are available: Pod cannot be scheduled because the group 'B' has only 1 pods, but needs 2. preemption: 0/3 nodes are available: 3 No preemption victims found for incoming pod..."
```

scheduler nginx-2 log(後來再次被判斷有沒有滿足schedule的條件)

```
I0605 06:40:07.433262    1 log.go:194] Pod nginx-2 is in Prefilter phase.
I0605 06:40:07.433301    1 log.go:194] groupLabel: B
I0605 06:40:07.433305    1 log.go:194] minAvailable: 2
I0605 06:40:07.434408    1 log.go:194] Pod nginx-2 is in Score phase. Calculate the score of Node kind-worker.
I0605 06:40:07.434430    1 log.go:194] original allocatableMemory = 1376718848
I0605 06:40:07.434446    1 log.go:194] Pod kindnet-b4fsb Memory Resources Limit: 52428800
I0605 06:40:07.434465    1 log.go:194] Pod kube-proxy-mtwj7 Memory Resources Limit: 0
I0605 06:40:07.434490    1 log.go:194] Pod nginx-4 Memory Resources Limit: 104857600
I0605 06:40:07.434499    1 log.go:194] node kind-worker has been requested memory = 157286400
I0605 06:40:07.434504    1 log.go:194] score Mode: Most
I0605 06:40:07.434509    1 log.go:194] now allocatableMemory: 1219432448
I0605 06:40:07.434519    1 log.go:194] Node kind-worker score is 1219432448.
I0605 06:40:07.434529    1 log.go:194]
I0605 06:40:07.434573    1 log.go:194] Pod nginx-2 is in Score phase. Calculate the score of Node kind-worker2.
I0605 06:40:07.434590    1 log.go:194] original allocatableMemory = 1913589760
I0605 06:40:07.434606    1 log.go:194] Pod kube-proxy-q5d2k Memory Resources Limit: 0
I0605 06:40:07.434621    1 log.go:194] Pod kindnet-pz8kw Memory Resources Limit: 52428800
I0605 06:40:07.434625    1 log.go:194] Pod my-scheduler-69cfc986c7-dcp92 Memory Resources Limit: 0
I0605 06:40:07.434635    1 log.go:194] Pod nginx-3 Memory Resources Limit: 104857600
I0605 06:40:07.434648    1 log.go:194] Pod nginx Memory Resources Limit: 419430400
I0605 06:40:07.434653    1 log.go:194] node kind-worker2 has been requested memory = 1520435200
I0605 06:40:07.434659    1 log.go:194] score Mode: Most
I0605 06:40:07.434665    1 log.go:194] now allocatableMemory: 393154560
I0605 06:40:07.434670    1 log.go:194] Node kind-worker2 score is 393154560.
I0605 06:40:07.434674    1 log.go:194]
I0605 06:40:07.442725    1 schedule_one.go:252] "Successfully bound pod to node" pod="default/nginx-2" node="kind-worker" evaluatedNodes=3 feasibleNodes=2
```

scheduler nginx-3 log

```
I0605 06:34:51.741439 1 log.go:194] Pod nginx-3 is in Prefilter phase.
I0605 06:34:51.741474 1 log.go:194] groupLabel: B
I0605 06:34:51.741478 1 log.go:194] minAvailable: 2
I0605 06:34:51.741918 1 log.go:194] Pod nginx-3 is in Score phase. Calculate the score of Node kind-worker2.
I0605 06:34:51.741943 1 log.go:194] original allocatableMemory = 1913589760
I0605 06:34:51.741952 1 log.go:194] Pod kube-proxy-q5d2k Memory Resources Limit: 0
I0605 06:34:51.741959 1 log.go:194] Pod kindnet-pz8kw Memory Resources Limit: 52428800
I0605 06:34:51.741966 1 log.go:194] Pod my-scheduler-69cfc986c7-dcp92 Memory Resources Limit: 0
I0605 06:34:51.741974 1 log.go:194] Pod nginx Memory Resources Limit: 419430400
I0605 06:34:51.741980 1 log.go:194] node kind-worker2 has been requested memory = 471859200
I0605 06:34:51.741990 1 log.go:194] Pod nginx-3 is in Score phase. Calculate the score of Node kind-worker.
I0605 06:34:51.742008 1 log.go:194] original allocatableMemory = 1376718848
I0605 06:34:51.742014 1 log.go:194] Pod kindnet-b4fsb Memory Resources Limit: 52428800
I0605 06:34:51.742020 1 log.go:194] Pod kube-proxy-mtwj7 Memory Resources Limit: 0
I0605 06:34:51.742024 1 log.go:194] node kind-worker has been requested memory = 52428800
I0605 06:34:51.742028 1 log.go:194] score Mode: Most
I0605 06:34:51.742031 1 log.go:194] now allocatableMemory: 1324290048
I0605 06:34:51.742035 1 log.go:194] Node kind-worker score is 1324290048.
I0605 06:34:51.742040 1 log.go:194]
I0605 06:34:51.742057 1 log.go:194] score Mode: Most
I0605 06:34:51.742068 1 log.go:194] now allocatableMemory: 1441730560
I0605 06:34:51.742072 1 log.go:194] Node kind-worker2 score is 1441730560.
I0605 06:34:51.742075 1 log.go:194]
I0605 06:34:51.745538 1 schedule_one.go:252] "Successfully bound pod to node" pod="default/nginx-3" node="kind-worker2" evaluatedNodes=3 feasibleNodes=2
```

scheduler nginx-4 log

```
I0605 06:34:51.793208 1 log.go:194] Pod nginx-4 is in Prefilter phase.
I0605 06:34:51.793229 1 log.go:194] groupLabel: B
I0605 06:34:51.793233 1 log.go:194] minAvailable: 2
I0605 06:34:51.793482 1 log.go:194] Pod nginx-4 is in Score phase. Calculate the score of Node kind-worker.
I0605 06:34:51.793497 1 log.go:194] original allocatableMemory = 1376718848
I0605 06:34:51.793503 1 log.go:194] Pod kindnet-b4fsb Memory Resources Limit: 52428800
I0605 06:34:51.793507 1 log.go:194] Pod kube-proxy-mtwj7 Memory Resources Limit: 0
I0605 06:34:51.793511 1 log.go:194] node kind-worker has been requested memory = 52428800
I0605 06:34:51.793514 1 log.go:194] score Mode: Most
I0605 06:34:51.793517 1 log.go:194] now allocatableMemory: 1324290048
I0605 06:34:51.793521 1 log.go:194] Node kind-worker score is 1324290048.
I0605 06:34:51.793531 1 log.go:194]
I0605 06:34:51.793538 1 log.go:194] Pod nginx-4 is in Score phase. Calculate the score of Node kind-worker2.
I0605 06:34:51.793542 1 log.go:194] original allocatableMemory = 1913589760
I0605 06:34:51.793545 1 log.go:194] Pod kube-proxy-q5d2k Memory Resources Limit: 0
I0605 06:34:51.793550 1 log.go:194] Pod kindnet-pz8kw Memory Resources Limit: 52428800
I0605 06:34:51.793553 1 log.go:194] Pod my-scheduler-69cfc986c7-dcp92 Memory Resources Limit: 0
I0605 06:34:51.793558 1 log.go:194] Pod nginx Memory Resources Limit: 419430400
I0605 06:34:51.793562 1 log.go:194] Pod nginx-3 Memory Resources Limit: 1048576000
I0605 06:34:51.793565 1 log.go:194] node kind-worker2 has been requested memory = 1520435200
I0605 06:34:51.793569 1 log.go:194] score Mode: Most
I0605 06:34:51.793572 1 log.go:194] now allocatableMemory: 393154560
I0605 06:34:51.793575 1 log.go:194] Node kind-worker2 score is 393154560.
I0605 06:34:51.793577 1 log.go:194]
I0605 06:34:51.797913 1 schedule_one.go:252] "Successfully bound pod to node" pod="default/nginx-4" node="kind-worker" evaluatedNodes=3 feasibleNodes=2
```

• Least Mode

nginx的minAvailable=1，所以該Pod一開始被建立時就會被分配到node，這時候kind-worker1可分配的memory比較小，所以被分配給kind-worker1。

接著nginx-2被建立但未達到minAvailable標準，所以會先pending。

接著nginx-3被建立也達到minAvailable標準，不過這時候kind-worker1可分配的memory不足以分配給nginx-3的memory request=1000Mi，所以直接被分配給kind-worker2。

接著nginx-4被建立也達到minAvailable標準，這時候kind-worker2可分配的memory比較小，所以被分配給kind-worker2。

接著過5分鐘左右nginx-2再次被檢查能否被schedule，這時候該group已經滿足minAvailable了，所以會被分配給此時可分配的memory比較小的kind-worker2。

```
student@ds-student12:~/NTHU-Scheduler-Plugin$ kubectl get po -o wide
NAME                 READY   STATUS    RESTARTS   AGE   IP              NODE       NOMINATED NODE   READINESS GATE
my-scheduler-69cfc986c7-6khq7  1/1     Running   0           5m15s  10.244.2.13    kind-worker2  <none>           <none>
nginx                  1/1     Running   0           4m41s  10.244.1.6     kind-worker   <none>           <none>
nginx-2               0/1     Pending   0           4m41s  <none>         <none>         <none>           <none>
nginx-3               1/1     Running   0           4m41s  10.244.2.14    kind-worker2  <none>           <none>
nginx-4               1/1     Running   0           4m41s  10.244.2.15    kind-worker2  <none>           <none>

student@ds-student12:~/NTHU-Scheduler-Plugin$ kubectl get po -o wide
NAME                 READY   STATUS    RESTARTS   AGE   IP              NODE       NOMINATED NODE   READINESS GATE
my-scheduler-69cfc986c7-6khq7  1/1     Running   0           6m8s   10.244.2.13    kind-worker2  <none>           <none>
nginx                  1/1     Running   0           5m34s  10.244.1.6     kind-worker   <none>           <none>
nginx-2               1/1     Running   0           5m34s  10.244.2.16    kind-worker2  <none>           <none>
nginx-3               1/1     Running   0           5m34s  10.244.2.14    kind-worker2  <none>           <none>
nginx-4               1/1     Running   0           5m34s  10.244.2.15    kind-worker2  <none>           <none>
```

scheduler nginx log

```
I0605 07:34:31.492881 1 log.go:194] Pod nginx is in Prefilter phase.
I0605 07:34:31.492911 1 log.go:194] groupLabel: A
I0605 07:34:31.492915 1 log.go:194] minAvailable: 1
I0605 07:34:31.493251 1 log.go:194] Pod nginx is in Score phase. Calculate the score of Node kind-worker.
I0605 07:34:31.493267 1 log.go:194] original allocatableMemory = 1376718848
I0605 07:34:31.493271 1 log.go:194] node kind-worker has been requested memory = 52428800
I0605 07:34:31.493288 1 log.go:194] score Mode: Least
I0605 07:34:31.493301 1 log.go:194] now allocatableMemory: 1324290048
I0605 07:34:31.493307 1 log.go:194] Node kind-worker score is 75.
I0605 07:34:31.493312 1 log.go:194]
I0605 07:34:31.493336 1 log.go:194] Pod nginx is in Score phase. Calculate the score of Node kind-worker2.
I0605 07:34:31.493341 1 log.go:194] original allocatableMemory = 1913589760
I0605 07:34:31.493346 1 log.go:194] node kind-worker2 has been requested memory = 52428800
I0605 07:34:31.493350 1 log.go:194] score Mode: Least
I0605 07:34:31.493354 1 log.go:194] now allocatableMemory: 1861160960
I0605 07:34:31.493358 1 log.go:194] Node kind-worker2 score is 53.
I0605 07:34:31.493362 1 log.go:194]
I0605 07:34:31.498573 1 schedule_one.go:252] "Successfully bound pod to node" pod="default/nginx" node="kind-worker" evaluatedNodes=3 feasibleNodes=2
```

scheduler nginx-2 log

```
I0605 07:34:31.537025 1 log.go:194] Pod nginx-2 is in Prefilter phase.
I0605 07:34:31.537052 1 log.go:194] groupLabel: B
I0605 07:34:31.537057 1 log.go:194] minAvailable: 2
I0605 07:34:31.537085 1 log.go:194] pods is not available
I0605 07:34:31.537275 1 schedule_one.go:867] "Unable to schedule pod; no fit; waiting" pod="default/nginx-2" err="0/3 nodes are available: Pod cannot be scheduled because the group 'B' has only 1 pods, but needs 2. preemption: 0/3 nodes are available: 3 No preemption victims found for incoming pod.."
```

scheduler nginx-2 log(後來再次被判斷有沒有滿足schedule的條件)

```
I0605 07:39:59.581334 1 log.go:194] Pod nginx-2 is in Prefilter phase.
I0605 07:39:59.581375 1 log.go:194] groupLabel: B
I0605 07:39:59.581382 1 log.go:194] minAvailable: 2
I0605 07:39:59.582142 1 log.go:194] Pod nginx-2 is in Score phase. Calculate the score of Node kind-worker2.
I0605 07:39:59.582160 1 log.go:194] original allocatableMemory = 1913589760
I0605 07:39:59.582173 1 log.go:194] node kind-worker2 has been requested memory = 1205862400
I0605 07:39:59.582181 1 log.go:194] score Mode: Least
I0605 07:39:59.582187 1 log.go:194] now allocatableMemory: 707727360
I0605 07:39:59.582193 1 log.go:194] Node kind-worker2 score is 141.
I0605 07:39:59.582197 1 log.go:194]
I0605 07:39:59.582237 1 log.go:194] Pod nginx-2 is in Score phase. Calculate the score of Node kind-worker.
I0605 07:39:59.582251 1 log.go:194] original allocatableMemory = 1376718848
I0605 07:39:59.582256 1 log.go:194] node kind-worker has been requested memory = 471859200
I0605 07:39:59.582261 1 log.go:194] score Mode: Least
I0605 07:39:59.582266 1 log.go:194] now allocatableMemory: 904859648
I0605 07:39:59.582271 1 log.go:194] Node kind-worker score is 110.
I0605 07:39:59.582275 1 log.go:194]
I0605 07:39:59.587938 1 schedule_one.go:252] "Successfully bound pod to node" pod="default/nginx-2" node="kind-worker2" evaluatedNodes=3 feasibleNodes=2
```

scheduler nginx-3 log

```
I0605 07:34:31.581753 1 log.go:194] Pod nginx-3 is in Prefilter phase.
I0605 07:34:31.581785 1 log.go:194] groupLabel: B
I0605 07:34:31.581791 1 log.go:194] minAvailable: 2
I0605 07:34:31.584562 1 schedule_one.go:252] "Successfully bound pod to node" pod="default/nginx-3" node="kind-worker2" evaluatedNodes=3 feasibleNodes=1
```

scheduler nginx-4 log

```
I0605 07:34:31.629526 1 log.go:194] Pod nginx-4 is in Prefilter phase.
I0605 07:34:31.629546 1 log.go:194] groupLabel: B
I0605 07:34:31.629550 1 log.go:194] minAvailable: 2
I0605 07:34:31.629773 1 log.go:194] Pod nginx-4 is in Score phase. Calculate the score of Node kind-worker.
I0605 07:34:31.629784 1 log.go:194] original allocatableMemory = 1376718848
I0605 07:34:31.629788 1 log.go:194] node kind-worker has been requested memory = 471859200
I0605 07:34:31.629791 1 log.go:194] score Mode: Least
I0605 07:34:31.629795 1 log.go:194] now allocatableMemory: 904859648
I0605 07:34:31.629798 1 log.go:194] Node kind-worker score is 110.
I0605 07:34:31.629801 1 log.go:194]
I0605 07:34:31.629813 1 log.go:194] Pod nginx-4 is in Score phase. Calculate the score of Node kind-worker2.
I0605 07:34:31.629822 1 log.go:194] original allocatableMemory = 1913589760
I0605 07:34:31.629825 1 log.go:194] node kind-worker2 has been requested memory = 1101004800
I0605 07:34:31.629828 1 log.go:194] score Mode: Least
I0605 07:34:31.629832 1 log.go:194] now allocatableMemory: 812584960
I0605 07:34:31.629835 1 log.go:194] Node kind-worker2 score is 123.
I0605 07:34:31.629838 1 log.go:194]
I0605 07:34:31.635102 1 schedule_one.go:252] "Successfully bound pod to node" pod="default/nginx-4" node="kind-worker2" evaluatedNodes=3 feasibleNodes=2
```