Selecting optimal new nodes for unscheduled pods

Problem description

Imagine you have a Kubernetes cluster that currently full, and there is currently a number of unscheduled pods. You need to make the cluster bigger by adding new nodes to accommodate these pods.

Unscheduled pods are represented like this:

```
[
  {
    "name": "pod1",
    "cpuRequest": 0.4,
    "memoryRequest": 0.5,
    "zone": "B"
  },
  {
    "name": "pod2",
    "cpuRequest": 1,
    "memoryRequest": 0.5,
    "zone": null
  },
 .....
]
```

Pods will always have requested amount of CPU and memory; they may or may not require a specific zone ("A" or "B") - if zone is not provided, pod can go into nodes on either zone.

You need to select optimal nodes to add to Kubernetes cluster so that the pods get enough capacity to get scheduled. You have to select from available node types, which are defined like this:

```
[
  {
    "name": "node_2_4_A",
    "cpu": 2,
    "memory": 4,
    "zone": "A",
    "cost": 9.415777348576905
  },
  {
    "name": "node_2_4_B",
    "cpu": 2,
    "memory": 4,
    "zone": "B",
    "cost": 5.050512748885945
  },
...
]
```

Each node type has amount of CPU and Memory, it's network zone, and cost associated with it.

Your task is to find cheapest configuration of nodes that fits provided pod list. Requirements for the result:

- Node type can be reused, e.g. your result can contain two nodes of type `node_2_4_B` and three nodes of type `node_2_4_A`;
- There is at least one way to fit all pods into these nodes, so that totals of requests do not exceed node capacity, e.g.:
  - Node 1 (node_2_4_a): pod1 (requires 1 cpu, 2 ram, requires zone A), pod2 (1 cpu, 2 ram)
  - Node 2 (node_2_4_b): pod3 (requires 0.5cpu, 1ram), pod4 (0.5cpu, 1ram, zone B), pod5 (1 cpu, 2 ram)
- Pods that require a specific zone, must have a node for that zone;
- It is the cheapest possible configuration. There are multiple ways to fit the pods into nodes (e.g. two smaller nodes or one bigger node?), you have to select cheapest one.

Analogy without Kubernetes

Image PODs are different sizes and shapes apples, oranges and plums.

Nodes are different size boxes.

Zone is color of box.

Apples go to green boxes, Oranges go to yellow boxes, plums can go to any box. Pack all fruits to smallest volume.

Results

The resulting program must be written in Go.

At the minimum, the program must print the resulting configuration, and which pod should go to which node, e.g.:

```
node_2_4_B: pod1, pod99
node_2_4_B: pod2, pod3
node_2_32_B: pod5, pod7, pod85, pod33, pod55
...
```

You can choose to add intermediate log to demonstrate the progress, debugging log etc.

Provide whole solution as zipped Golang project, including only the files you'd commit to Git repo. The code polish should be at the level you'd expect a pull request to be, so that reviewer has sufficient details to understand what's going on.

Task data

List of unscheduled pods:

```
[
  {
    "name": "pod1",
    "cpuRequest": 1,
    "memoryRequest": 0.2,
    "zone": "A"
  },
  {
    "name": "pod2",
    "cpuRequest": 1,
    "memoryRequest": 0.9,
    "zone": "A"
  },
```

```
  {
    "name": "pod3",
    "cpuRequest": 0.4,
    "memoryRequest": 0.2,
    "zone": "B"
  },
  {
    "name": "pod4",
    "cpuRequest": 0.4,
    "memoryRequest": 0.2,
    "zone": null
  },
  {
    "name": "pod5",
    "cpuRequest": 0.4,
    "memoryRequest": 0.2,
    "zone": "A"
  },
  {
    "name": "pod6",
    "cpuRequest": 0.2,
    "memoryRequest": 0.2,
    "zone": null
  },
  {
    "name": "pod7",
    "cpuRequest": 0.4,
    "memoryRequest": 0.5,
    "zone": "A"
  },
  {
    "name": "pod8",
    "cpuRequest": 0.4,
    "memoryRequest": 0.2,
    "zone": "A"
  },
  {
    "name": "pod9",
    "cpuRequest": 0.2,
    "memoryRequest": 0.5,
    "zone": "A"
  },
  {
    "name": "pod10",
    "cpuRequest": 1,
    "memoryRequest": 0.2,
    "zone": null
  },
  {
    "name": "pod11",
```

```
    "cpuRequest": 0.2,
    "memoryRequest": 0.2,
    "zone": null
  },
  {
    "name": "pod12",
    "cpuRequest": 0.4,
    "memoryRequest": 0.2,
    "zone": null
  },
  {
    "name": "pod13",
    "cpuRequest": 0.2,
    "memoryRequest": 0.2,
    "zone": null
  },
  {
    "name": "pod14",
    "cpuRequest": 0.4,
    "memoryRequest": 0.2,
    "zone": null
  },
  {
    "name": "pod15",
    "cpuRequest": 0.4,
    "memoryRequest": 0.2,
    "zone": null
  },
  {
    "name": "pod16",
    "cpuRequest": 0.2,
    "memoryRequest": 0.5,
    "zone": "B"
  },
  {
    "name": "pod17",
    "cpuRequest": 0.2,
    "memoryRequest": 0.2,
    "zone": "B"
  },
  {
    "name": "pod18",
    "cpuRequest": 0.4,
    "memoryRequest": 0.2,
    "zone": null
  },
  {
    "name": "pod19",
    "cpuRequest": 0.4,
    "memoryRequest": 0.5,
```

```
    "zone": "B"
  },
  {
    "name": "pod20",
    "cpuRequest": 0.4,
    "memoryRequest": 0.2,
    "zone": null
  },
  {
    "name": "pod21",
    "cpuRequest": 0.4,
    "memoryRequest": 0.2,
    "zone": "A"
  },
  {
    "name": "pod22",
    "cpuRequest": 0.4,
    "memoryRequest": 0.2,
    "zone": "A"
  },
  {
    "name": "pod23",
    "cpuRequest": 1,
    "memoryRequest": 0.2,
    "zone": "A"
  },
  {
    "name": "pod24",
    "cpuRequest": 0.2,
    "memoryRequest": 0.5,
    "zone": null
  },
  {
    "name": "pod25",
    "cpuRequest": 1,
    "memoryRequest": 0.2,
    "zone": null
  },
  {
    "name": "pod26",
    "cpuRequest": 0.2,
    "memoryRequest": 0.9,
    "zone": "A"
  },
  {
    "name": "pod27",
    "cpuRequest": 0.2,
    "memoryRequest": 0.2,
    "zone": null
  },
```

```
  {
    "name": "pod28",
    "cpuRequest": 0.4,
    "memoryRequest": 0.9,
    "zone": null
  },
  {
    "name": "pod29",
    "cpuRequest": 0.2,
    "memoryRequest": 0.9,
    "zone": null
  },
  {
    "name": "pod30",
    "cpuRequest": 1,
    "memoryRequest": 0.2,
    "zone": null
  },
  {
    "name": "pod31",
    "cpuRequest": 0.4,
    "memoryRequest": 0.5,
    "zone": "A"
  },
  {
    "name": "pod32",
    "cpuRequest": 1,
    "memoryRequest": 0.5,
    "zone": null
  },
  {
    "name": "pod33",
    "cpuRequest": 0.2,
    "memoryRequest": 0.9,
    "zone": null
  },
  {
    "name": "pod34",
    "cpuRequest": 0.4,
    "memoryRequest": 0.2,
    "zone": null
  },
  {
    "name": "pod35",
    "cpuRequest": 0.4,
    "memoryRequest": 0.2,
    "zone": "A"
  },
  {
    "name": "pod36",
```

```
    "cpuRequest": 0.4,
    "memoryRequest": 0.2,
    "zone": null
  },
  {
    "name": "pod37",
    "cpuRequest": 0.4,
    "memoryRequest": 0.5,
    "zone": null
  },
  {
    "name": "pod38",
    "cpuRequest": 0.2,
    "memoryRequest": 0.2,
    "zone": "A"
  },
  {
    "name": "pod39",
    "cpuRequest": 0.4,
    "memoryRequest": 0.2,
    "zone": null
  },
  {
    "name": "pod40",
    "cpuRequest": 1,
    "memoryRequest": 0.2,
    "zone": null
  },
  {
    "name": "pod41",
    "cpuRequest": 0.4,
    "memoryRequest": 0.5,
    "zone": null
  },
  {
    "name": "pod42",
    "cpuRequest": 0.4,
    "memoryRequest": 0.9,
    "zone": null
  },
  {
    "name": "pod43",
    "cpuRequest": 0.2,
    "memoryRequest": 0.5,
    "zone": "A"
  },
  {
    "name": "pod44",
    "cpuRequest": 0.2,
    "memoryRequest": 0.2,
```

```
    "zone": null
  },
  {
    "name": "pod45",
    "cpuRequest": 1,
    "memoryRequest": 0.2,
    "zone": null
  },
  {
    "name": "pod46",
    "cpuRequest": 0.4,
    "memoryRequest": 0.2,
    "zone": null
  },
  {
    "name": "pod47",
    "cpuRequest": 0.2,
    "memoryRequest": 0.5,
    "zone": "A"
  },
  {
    "name": "pod48",
    "cpuRequest": 0.4,
    "memoryRequest": 0.2,
    "zone": "B"
  },
  {
    "name": "pod49",
    "cpuRequest": 0.4,
    "memoryRequest": 0.2,
    "zone": null
  },
  {
    "name": "pod50",
    "cpuRequest": 0.2,
    "memoryRequest": 0.9,
    "zone": null
  },
  {
    "name": "pod51",
    "cpuRequest": 1,
    "memoryRequest": 0.2,
    "zone": null
  },
  {
    "name": "pod52",
    "cpuRequest": 0.4,
    "memoryRequest": 0.5,
    "zone": null
  },
```

```
{
  "name": "pod53",
  "cpuRequest": 1,
  "memoryRequest": 0.9,
  "zone": null
},
{
  "name": "pod54",
  "cpuRequest": 0.4,
  "memoryRequest": 0.2,
  "zone": "B"
},
{
  "name": "pod55",
  "cpuRequest": 0.2,
  "memoryRequest": 0.9,
  "zone": "B"
},
{
  "name": "pod56",
  "cpuRequest": 0.2,
  "memoryRequest": 0.5,
  "zone": "B"
},
{
  "name": "pod57",
  "cpuRequest": 0.2,
  "memoryRequest": 0.2,
  "zone": null
},
{
  "name": "pod58",
  "cpuRequest": 0.4,
  "memoryRequest": 0.2,
  "zone": null
},
{
  "name": "pod59",
  "cpuRequest": 1,
  "memoryRequest": 0.2,
  "zone": null
},
{
  "name": "pod60",
  "cpuRequest": 0.2,
  "memoryRequest": 0.2,
  "zone": null
},
{
  "name": "pod61",
```

```
    "cpuRequest": 0.4,
    "memoryRequest": 0.2,
    "zone": null
  },
  {
    "name": "pod62",
    "cpuRequest": 0.4,
    "memoryRequest": 0.2,
    "zone": "B"
  },
  {
    "name": "pod63",
    "cpuRequest": 0.4,
    "memoryRequest": 0.2,
    "zone": null
  },
  {
    "name": "pod64",
    "cpuRequest": 0.4,
    "memoryRequest": 0.5,
    "zone": null
  },
  {
    "name": "pod65",
    "cpuRequest": 0.4,
    "memoryRequest": 0.2,
    "zone": null
  },
  {
    "name": "pod66",
    "cpuRequest": 0.4,
    "memoryRequest": 0.2,
    "zone": "B"
  },
  {
    "name": "pod67",
    "cpuRequest": 0.4,
    "memoryRequest": 0.2,
    "zone": "A"
  },
  {
    "name": "pod68",
    "cpuRequest": 1,
    "memoryRequest": 0.2,
    "zone": "A"
  },
  {
    "name": "pod69",
    "cpuRequest": 0.4,
    "memoryRequest": 0.2,
```

```
    "zone": null
  },
  {
    "name": "pod70",
    "cpuRequest": 1,
    "memoryRequest": 0.2,
    "zone": null
  },
  {
    "name": "pod71",
    "cpuRequest": 0.4,
    "memoryRequest": 0.9,
    "zone": null
  },
  {
    "name": "pod72",
    "cpuRequest": 0.4,
    "memoryRequest": 0.2,
    "zone": null
  },
  {
    "name": "pod73",
    "cpuRequest": 1,
    "memoryRequest": 0.5,
    "zone": "A"
  },
  {
    "name": "pod74",
    "cpuRequest": 1,
    "memoryRequest": 0.2,
    "zone": "B"
  },
  {
    "name": "pod75",
    "cpuRequest": 1,
    "memoryRequest": 0.2,
    "zone": "A"
  },
  {
    "name": "pod76",
    "cpuRequest": 0.4,
    "memoryRequest": 0.9,
    "zone": null
  },
  {
    "name": "pod77",
    "cpuRequest": 1,
    "memoryRequest": 0.2,
    "zone": "A"
  },
```

```
{
  "name": "pod78",
  "cpuRequest": 1,
  "memoryRequest": 0.2,
  "zone": null
},
{
  "name": "pod79",
  "cpuRequest": 0.2,
  "memoryRequest": 0.5,
  "zone": "B"
},
{
  "name": "pod80",
  "cpuRequest": 0.4,
  "memoryRequest": 0.5,
  "zone": "A"
},
{
  "name": "pod81",
  "cpuRequest": 0.4,
  "memoryRequest": 0.2,
  "zone": null
},
{
  "name": "pod82",
  "cpuRequest": 0.4,
  "memoryRequest": 0.2,
  "zone": "A"
},
{
  "name": "pod83",
  "cpuRequest": 0.4,
  "memoryRequest": 0.5,
  "zone": null
},
{
  "name": "pod84",
  "cpuRequest": 0.4,
  "memoryRequest": 0.2,
  "zone": "B"
},
{
  "name": "pod85",
  "cpuRequest": 0.2,
  "memoryRequest": 0.5,
  "zone": null
},
{
  "name": "pod86",
```

```
      "cpuRequest": 0.4,
      "memoryRequest": 0.2,
      "zone": null
    },
    {
      "name": "pod87",
      "cpuRequest": 1,
      "memoryRequest": 0.2,
      "zone": null
    },
    {
      "name": "pod88",
      "cpuRequest": 0.4,
      "memoryRequest": 0.2,
      "zone": null
    },
    {
      "name": "pod89",
      "cpuRequest": 0.4,
      "memoryRequest": 0.2,
      "zone": null
    },
    {
      "name": "pod90",
      "cpuRequest": 0.4,
      "memoryRequest": 0.2,
      "zone": null
    },
    {
      "name": "pod91",
      "cpuRequest": 0.4,
      "memoryRequest": 0.2,
      "zone": null
    },
    {
      "name": "pod92",
      "cpuRequest": 0.4,
      "memoryRequest": 0.2,
      "zone": null
    },
    {
      "name": "pod93",
      "cpuRequest": 0.4,
      "memoryRequest": 0.9,
      "zone": null
    },
    {
      "name": "pod94",
      "cpuRequest": 0.4,
      "memoryRequest": 0.2,
```

```
    "zone": null
  },
  {
    "name": "pod95",
    "cpuRequest": 0.4,
    "memoryRequest": 0.2,
    "zone": "A"
  },
  {
    "name": "pod96",
    "cpuRequest": 1,
    "memoryRequest": 0.2,
    "zone": "B"
  },
  {
    "name": "pod97",
    "cpuRequest": 1,
    "memoryRequest": 0.9,
    "zone": null
  },
  {
    "name": "pod98",
    "cpuRequest": 1,
    "memoryRequest": 0.2,
    "zone": "A"
  },
  {
    "name": "pod99",
    "cpuRequest": 0.4,
    "memoryRequest": 0.2,
    "zone": null
  },
  {
    "name": "pod100",
    "cpuRequest": 0.4,
    "memoryRequest": 0.5,
    "zone": "B"
  }
]
```

Node types database:

```
[
  {
    "name": "node_2_4_A",
    "cpu": 2,
    "memory": 4,
    "zone": "A",
```

```
    "cost": 9.415777348576905,
  },
  {
    "name": "node_2_4_B",
    "cpu": 2,
    "memory": 4,
    "zone": "B",
    "cost": 5.050512748885945,
  },
  {
    "name": "node_2_32_A",
    "cpu": 2,
    "memory": 32,
    "zone": "A",
    "cost": 27.191362319729265,
  },
  {
    "name": "node_2_32_B",
    "cpu": 2,
    "memory": 32,
    "zone": "B",
    "cost": 27.283768568406717,
  },
  {
    "name": "node_2_64_B",
    "cpu": 2,
    "memory": 64,
    "zone": "B",
    "cost": 55.49171423380459,
  },
  {
    "name": "node_4_4_B",
    "cpu": 4,
    "memory": 4,
    "zone": "B",
    "cost": 4.151216196760611,
  },
  {
    "name": "node_4_16_A",
    "cpu": 4,
    "memory": 16,
    "zone": "A",
    "cost": 16.159308272622454,
  },
  {
    "name": "node_4_16_B",
    "cpu": 4,
    "memory": 16,
    "zone": "B",
    "cost": 17.911219635980338,
```

```
  },
  {
    "name": "node_4_32_B",
    "cpu": 4,
    "memory": 32,
    "zone": "B",
    "cost": 32.75033937180745,
  },
  {
    "name": "node_4_64_A",
    "cpu": 4,
    "memory": 64,
    "zone": "A",
    "cost": 56.7649121361059,
  },
  {
    "name": "node_4_64_B",
    "cpu": 4,
    "memory": 64,
    "zone": "B",
    "cost": 57.12195021009196,
  },
  {
    "name": "node_8_4_A",
    "cpu": 8,
    "memory": 4,
    "zone": "A",
    "cost": 4.400643066159067,
  },
  {
    "name": "node_8_4_B",
    "cpu": 8,
    "memory": 4,
    "zone": "B",
    "cost": 6.126846682521043,
  },
  {
    "name": "node_8_16_A",
    "cpu": 8,
    "memory": 16,
    "zone": "A",
    "cost": 14.039807485613037,
  },
  {
    "name": "node_8_32_A",
    "cpu": 8,
    "memory": 32,
    "zone": "A",
    "cost": 27.89527652427282,
  },
```

```
    {
      "name": "node_8_32_B",
      "cpu": 8,
      "memory": 32,
      "zone": "B",
      "cost": 29.728304751242618,
    },
    {
      "name": "node_8_64_A",
      "cpu": 8,
      "memory": 64,
      "zone": "A",
      "cost": 57.66791169120426,
    },
    {
      "name": "node_8_64_B",
      "cpu": 8,
      "memory": 64,
      "zone": "B",
      "cost": 53.08978776570531,
    }
  ]
```


Print out a list of node types and final price for selected configuration.