a. Test Plan

1. run main() function with arbitrary input.
2. run MainTest provided.
3. run grade script provided.
4. write my own junit test program.

   I randomly pick two words in the dictionary and put them into either getWordLadderBFS() or getWordLadderDFS(). Then check returned ladder with verifyLadder().
   Run this 1000 times.

```
int t = 1000;
while(t-- > 0)
{
    int item1 = new Random().nextInt(size);
    int item2 = new Random().nextInt(size);
    int i = 0;
    for(String obj : dict)
    {
        if (i == item1)
            start = obj;
        if(i == item2)
            end = obj;
        i++;
    }

    System.out.println(start + " " + end);

    ArrayList<String> res = Main.getWordLadderBFS(start, end);

    if (res != null) {
        HashSet<String> set = new HashSet<String>(res);
        assertEquals(set.size(), res.size());
    }
    if(res.size() != 2)
        assertTrue(verifyLadder(res));
    else
        assertTrue(res.get(0).equals(start) && res.get(1).equals(end));
}
```

b. Test Cases for BFS

1.start money
a 8-rung word ladder exists between start and money.
start
stars
sears
bears
beads
bends
bonds
bones
boney
money

2.prone money
a 7-rung word ladder exists between prone and money.
prone
crone
clone
clons
coons
conns
cones
coney
money

3.great super
a 9-rung word ladder exists between great and super.
great
greet
gleet
fleet
fleer
flyer
slyer
sayer
saber
suber
super

4.fleet scart
a 5-rung word ladder exists between fleet and scart.
fleet
sleet
sheet
shent
scent

```
scant
scart
```

5.empty royal
```
no word ladder can be found between empty and royal.
```

c. Test Cases for DFS

1.start money
```
a 86-rung word ladder exists between start and money.
start
scart
scary
scaly
shaly
shily
slily
slimy
stimy
stime
slime
clime
glime
grime
grimy
gripy
grapy
gravy
grave
brave
crave
drave
trave
trove
drove
grove
prove
probe
prole
prone
crone
crony
irony
irone
drone
```

krone
trone
trine
brine
briny
bring
boing
doing
dying
eying
hying
lying
tying
thing
ahing
ohing
oping
aping
acing
icing
iring
wring
wrang
orang
prang
prong
wrong
wrung
brung
brunt
grunt
gaunt
daunt
haunt
jaunt
taunt
vaunt
vault
fault
gault
sault
sauls
mauls
mails
moils
molls
moles
modes

mokes
momes
mopes
mopey
money

2.prone money
a 57-rung word ladder exists between prone and money.
prone
crone
crony
irony
irone
drone
krone
trone
trine
brine
briny
bring
boing
doing
dying
eying
hying
lying
tying
thing
ahing
ohing
oping
aping
acing
icing
iring
wring
wrang
orang
prang
prong
wrong
wrung
brung
brunt
grunt
gaunt
daunt

haunt
jaunt
taunt
vaunt
vault
fault
gault
sault
sauls
mauls
mails
moils
molls
moles
modes
mokes
momes
mopes
mopey
money

3.great super
a 135-rung word ladder exists between great and super.
great
greet
gleet
sleet
sheet
sheer
sneer
speer
steer
sweer
swear
shear
smear
spear
speir
speil
speel
steel
steed
skeed
speed
spaed
spied
spier

shier
skier
slier
slyer
sayer
shyer
shoer
shoed
shied
skied
stied
styed
sayed
skyed
skyey
skiey
skies
shies
spies
sties
stirs
stars
scars
sears
soars
spars
spaes
spues
slues
sloes
shoes
shogs
slogs
smogs
snogs
snags
scags
shags
skags
slags
stags
swags
swigs
swims
shims
skims
slims
slams

scams
seams
shams
spams
spans
scans
swans
swabs
scabs
slabs
stabs
stobs
slobs
snobs
swobs
swops
scops
shops
slops
stops
steps
seeps
skeps
skees
skeen
sheen
sheep
sleep
steep
sweep
sweet
tweet
tweed
treed
breed
creed
dreed
freed
freer
fleer
flier
plier
prier
brier
crier
drier
frier
trier

wrier
wryer
dryer
fryer
pryer
payer
paper
caper
gaper
japer
raper
taper
toper
coper
doper
duper
super

4.fleet scart
a 28-rung word ladder exists between fleet and scart.
fleet
sleet
sheet
skeet
sweet
sweat
swept
slept
slipt
clipt
clapt
chapt
chart
chert
cheat
wheat
wheal
sheal
steal
steel
speel
spiel
shiel
shill
shall
scall
scald

scale
scare
scart

5.empty royal
no word ladder can be found between empty and royal.