

In [*]:

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import random
import datetime
from collections import deque, defaultdict

import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
import tensorflow as tf
from tensorflow.keras.models import Sequential
from tensorflow.keras.layers import Dense, Conv2D, Flatten, Dropout
from tensorflow.keras.optimizers import Adam
from lightgbm import LGBMClassifier, plot_importance

class Simulator:
    def __init__(self):

        self.sample_submission = pd.read_csv('module/sample_submission.csv')
        self.max_count = pd.read_csv('module/max_count.csv')
        self.stock = pd.read_csv('module/stock.csv')
        self.order = pd.read_csv('module/order.csv')

        cut = {f'BLK_{i}': 506 if i <= 2 else 400 for i in range(1,5) }

        ratio = {}

        ratio['BLK_1'] = {}
        ratio['BLK_1'][4] = 0.851
        ratio['BLK_1'][5] = 0.851
        ratio['BLK_1'][6] = 0.851

        ratio['BLK_2'] = {}
        ratio['BLK_2'][4] = 0.901
        ratio['BLK_2'][5] = 0.901
        ratio['BLK_2'][6] = 0.901

        ratio['BLK_3'] = {}
        ratio['BLK_3'][4] = 0.710
        ratio['BLK_3'][5] = 0.742
        ratio['BLK_3'][6] = 0.759

        ratio['BLK_4'] = {}
        ratio['BLK_4'][4] = 0.700
        ratio['BLK_4'][5] = 0.732
        ratio['BLK_4'][6] = 0.749

        self.cut = cut
        self.ratio = ratio

        order_dic = { }
        order = self.order

        for time, BLK_1, BLK_2, BLK_3, BLK_4 in zip(order['time'],order['BLK_1'],order['BLK_2'],order['BLK_3'],order['BLK_4']):

            order_count_time = str(pd.to_datetime(time) + pd.Timedelta(hours=18))
            order_dic[order_count_time] = {}

            order_dic[order_count_time][1] = BLK_1
            order_dic[order_count_time][2] = BLK_2
            order_dic[order_count_time][3] = BLK_3

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order_dic[order_count_time][4] = BLK_4

self.order_dic = order_dic

def make_init(self):

    PRT_dic = {time : {i : 0 for i in range(1,5)} for time in self.sample_submission['time']}
    MOL_dic = {time : {i : 0 for i in range(1,5)} for time in self.sample_submission['time']}
    BLK_dic = {time : {i : 0 for i in range(1,5)} for time in self.sample_submission['time']}

    ## 4/1일 00:00:00에 기초재고를 추가
    for i in range(1,5):
        PRT_dic['2020-04-01 00:00:00'][i] = int(self.stock[f'PRT_{i}'])
        MOL_dic['2020-04-01 00:00:00'][i] = int(self.stock[f'MOL_{i}'])
        BLK_dic['2020-04-01 00:00:00'][i] = int(self.stock[f'BLK_{i}'])

    self.PRT_dic = PRT_dic
    self.MOL_dic = MOL_dic
    self.BLK_dic = BLK_dic

def cal_prt_mol(self, machine_name):

    df = self.df

    # PRT 개수와 MOL 개수 구하기
    process_list = []
    for time, event, mol in zip(self.sample_submission['time'], df[f'Event_{machine_name}'], df[f'

        # check한 물의 개수만큼 PRT로
        try:
            val = int(event[-1])
        except:
            pass

        if event == 'PROCESS':
            process_list.append((time, mol, val))

    self.PRT_dic[time][val] += -mol

    for p_start, p_end in zip(process_list[:-48], process_list[48:]):

        p_start_time, p_start_mol, p_start_number = p_start
        p_end_time, p_end_mol, p_end_number = p_end

        self.MOL_dic[p_end_time][p_start_number] += p_start_mol * 0.975

def cal_blk(self):

    PRT_dic = self.PRT_dic
    MOL_dic = self.MOL_dic
    BLK_dic = self.BLK_dic
    order_dic = self.order_dic
    ratio = self.ratio
    cut = self.cut

    PRT_stock_dic = {time : {i : 0 for i in range(1,5)} for time in self.sample_submission['time']}
    MOL_stock_dic = {time : {i : 0 for i in range(1,5)} for time in self.sample_submission['time']}
    BLK_stock_dic = {time : {i : 0 for i in range(1,5)} for time in self.sample_submission['time']}

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blk_diffs = []
previous_time = [self.sample_submission['time'][0]] + list(self.sample_submission['time'])

for time, previous in zip(self.sample_submission['time'], previous_time[:-1]):

    month = int(time[6])

    for i in range(1,5):

        if str(time) == '2020-04-01 00:00:00':
            PRT_stock_dic[time][i] = PRT_dic[time][i]
            MOL_stock_dic[time][i] = MOL_dic[time][i]
            BLK_stock_dic[time][i] = BLK_dic[time][i]

        else:
            PRT_stock_dic[time][i] = PRT_stock_dic[previous][i] + PRT_dic[time][i]
            MOL_stock_dic[time][i] = MOL_stock_dic[previous][i] + MOL_dic[time][i]
            BLK_stock_dic[time][i] = BLK_stock_dic[previous][i] + BLK_dic[time][i]

            if int(time[11:13]) == 18:

                val = order_dic[time][i]

                if val > 0:
                    mol_number = i
                    mol = MOL_stock_dic[time][i]
                    MOL_stock_dic[time][i] = 0

                    blk_gen = int(mol*ratio[f'BLK_{i}'][month]*cut[f'BLK_{i}'])
                    blk_stock = BLK_stock_dic[time][i] + blk_gen
                    blk_diff = blk_stock - val

                    BLK_stock_dic[time][i] = blk_diff
                    blk_diffs.append(blk_diff)

self.PRT_stock_dic = PRT_stock_dic
self.MOL_stock_dic = MOL_stock_dic
self.BLK_stock_dic = BLK_stock_dic
self.blk_diffs = blk_diffs

def F(self, x, a): return 1 - x/a if x < a else 0

def cal_change_stop_time(self):

    df = self.df

    change_type = {'A': '', 'B': ''}
    change_num = 0
    change_time = 0
    stop_num = 0
    stop_time = 0
    previous_event = {'A': '', 'B': ''}
    for row in df.iterrows():
        for machine in ['A', 'B']:
            if 'CHANGE' in row[1][f'Event_{machine}']:
                change_time += 1
                if change_type[machine] != row[1][f'Event_{machine}'][-2:]:
                    change_num += 1
                    change_type[machine] = row[1][f'Event_{machine}'][-2:]

            if 'STOP' == row[1][f'Event_{machine}']:

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        stop_time += 1
        if previous_event[machine] != 'STOP':
            stop_num += 1

        previous_event[machine] = row[1][f'Event_{machine}']
    return change_time, change_num, stop_time, stop_num

def cal_score(self):

    p = 0
    q = 0
    for item in self.blk_diffs:
        if item < 0:
            p = p + abs(item)
        if item > 0:
            q = q + abs(item)

    N = sum([sum(self.order[f'BLK_{i}']) for i in range(1,5)])
    M = len(self.df) * 2

    c, c_n, s, s_n = self.cal_change_stop_time()

    self.score = 50*self.F(p, 10*N)+20*self.F(q, 10*N)+W
                20*self.F(c, M)/(1+0.1*c_n) + 10*self.F(s, M)/(1 + 0.1*s_n)

    self.p = p
    self.q = q
    self.N = N
    self.M = M
    self.c = c
    self.c_n = c_n
    self.s = s
    self.s_n = s_n

    return self.score

def make_stock_df(self):

    PRT_I = {i : [] for i in range(1,5)}
    MOL_I = {i : [] for i in range(1,5)}
    BLK_I = {i : [] for i in range(1,5)}

    for time in self.sample_submission['time']:
        for i in range(1,5):
            PRT_I[i].append(self.PRT_stock_dic[time][i])
            MOL_I[i].append(self.MOL_stock_dic[time][i])
            BLK_I[i].append(self.BLK_stock_dic[time][i])

    df_stock = pd.DataFrame(index = self.sample_submission['time'])

    for i in range(1,5):
        df_stock[f'PRT_{i}'] = PRT_I[i]
    for i in range(1,5):
        df_stock[f'MOL_{i}'] = MOL_I[i]
    for i in range(1,5):
        df_stock[f'BLK_{i}'] = BLK_I[i]

    self.df_stock = df_stock

def get_score(self,df):

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self.df = df
self.make_init()
self.cal_prt_mol('A')
self.cal_prt_mol('B')
self.cal_blk()
self.cal_score()
self.make_stock_df()

return self.score, self.df_stock

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submission_ini = pd.read_csv('module/sample_submission.csv')
order_ini = pd.read_csv('module/order.csv')

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order = order_ini.copy()
for i in range(35):
    order.loc[91+i,:] = ['0000-00-00', 0, 0, 0, 0]

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class Env:
    def __init__(self):
        # Event 종류
        self.mask = np.zeros([5], np.bool) # 가능한 이벤트 검사용 마스크
        self.event_map = {0:'CHECK_1', 1:'CHECK_2', 2:'CHECK_3', 3:'CHECK_4', 4:'PROCESS'}
        self.simulator = Simulator()

        self.sample_submission = pd.read_csv('module/sample_submission.csv')
        self.max_count = pd.read_csv('module/max_count.csv')
        self.stock = pd.read_csv('module/stock.csv')
        self.order = pd.read_csv('module/order.csv')

        cut = np.zeros(4) # blk_type

        cut[0] = 506
        cut[1] = 506
        cut[2] = 400
        cut[3] = 400

        ratio = np.zeros((3, 4)) # month, blk_type

        ratio[0][0] = 0.851
        ratio[1][0] = 0.851
        ratio[2][0] = 0.851

        ratio[0][1] = 0.901
        ratio[1][1] = 0.901
        ratio[2][1] = 0.901

        ratio[0][2] = 0.710
        ratio[1][2] = 0.742
        ratio[2][2] = 0.759

        ratio[0][3] = 0.700
        ratio[1][3] = 0.732
        ratio[2][3] = 0.749

        self.cut = cut
        self.ratio = ratio

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self.order = self.order.values[:, 1:]

self.reset()

def done(self):
    return self.s >= self.s_max

def state(self):
    inputs = np.array(order.loc[self.s//24:(self.s//24+30), 'BLK_1':'BLK_4']).reshape(-1)
    inputs = np.append(inputs, self.s%24)
    return inputs

def states(self):
    all_states = np.zeros((self.submission.shape[0] + 1, 125))

    for i in range(self.submission.shape[0] + 1):
        all_states[i][0:124] = np.array(order.loc[i//24:(i//24+30), 'BLK_1':'BLK_4']).reshape(-1)
        all_states[i][124] = i % 24

    return all_states

def reset(self):
    self.mask = np.zeros([5], np.bool)
    self.simulator = Simulator()

    self.submission = submission_ini.copy()
    self.submission.loc[:, 'PRT_1':'PRT_4'] = 0
    self.s = 0
    self.s_max = self.submission.shape[0]

    self.check_time = 28
    self.process = 0
    self.process_mode = 0
    self.process_time = 0
    self.last_score = 30

    self.global_process_time = 0

    self.PRT_stock = np.zeros(4)
    self.MOL_stock = np.zeros(4)
    self.BLK_stock = np.zeros(4)

    for i in range(4):
        self.PRT_stock[i] = int(self.stock[f'PRT_{i + 1}'])
        self.MOL_stock[i] = int(self.stock[f'MOL_{i + 1}'])
        self.BLK_stock[i] = int(self.stock[f'BLK_{i + 1}'])

    self.process_A = np.zeros((self.submission.shape[0], 4))
    self.process_B = np.zeros((self.submission.shape[0], 4))

    self.update_mask()

def step(self, actions):
    day = self.s // 24

    if day <= 30:
        month = 0
    elif day <= 61:

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        month = 1
    else:
        month = 2

    action1, action2 = actions

    out1 = self.event_map[action1]
    out2 = action2 / 2

    if out1 == 'CHECK_1':
        if self.process == 1:
            self.process = 0
            self.check_time = 28
        self.check_time -= 1
        self.process_mode = 0
        if self.check_time == 0:
            self.process = 1
            self.process_time = 0
    elif out1 == 'CHECK_2':
        if self.process == 1:
            self.process = 0
            self.check_time = 28
        self.check_time -= 1
        self.process_mode = 1
        if self.check_time == 0:
            self.process = 1
            self.process_time = 0
    elif out1 == 'CHECK_3':
        if self.process == 1:
            self.process = 0
            self.check_time = 28
        self.check_time -= 1
        self.process_mode = 2
        if self.check_time == 0:
            self.process = 1
            self.process_time = 0
    elif out1 == 'CHECK_4':
        if self.process == 1:
            self.process = 0
            self.check_time = 28
        self.check_time -= 1
        self.process_mode = 3
        if self.check_time == 0:
            self.process = 1
            self.process_time = 0
    elif out1 == 'PROCESS':
        self.process_time += 1
        self.global_process_time += 1
        if self.global_process_time >= 48:
            for i in range(4):
                self.MOL_stock[i] += self.process_A[self.global_process_time - 48][i] * 0.975
                self.MOL_stock[i] += self.process_B[self.global_process_time - 48][i] * 0.975
        if self.process_time == 140:
            self.process = 0
            self.check_time = 28

    self.submission.loc[self.s, 'Event_A'] = out1
    if self.submission.loc[self.s, 'Event_A'] == 'PROCESS' and self.s >= 24*23:
        self.submission.loc[self.s, 'MOL_A'] = out2
        self.process_A[self.global_process_time][self.process_mode] += out2
        self.process_B[self.global_process_time][self.process_mode] += out2

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else:
    self.submission.loc[self.s, 'MOL_A'] = 0

self.submission.loc[self.s, 'Event_B'] = self.submission.loc[self.s, 'Event_A']
self.submission.loc[self.s, 'MOL_B'] = self.submission.loc[self.s, 'MOL_A']

self.update_mask()
self.s += 1

if self.s % 24 == 18:
    blk_diff = 0
    for i in range(4):
        if self.order[day][i] != 0:

            self.BLK_stock[i] += int(self.MOL_stock[i] * self.cut[i] * self.ratio[month][i])
            self.MOL_stock[i] = 0
            self.BLK_stock[i] -= self.order[day][i]

            if self.BLK_stock[i] < 0:
                blk_diff += abs(self.BLK_stock[i]) * 5
            elif self.BLK_stock[i] > 0:
                blk_diff += abs(self.BLK_stock[i]) * 2

        if blk_diff != 0:
            blk_diff -= 500000
        reward = -(blk_diff / 50000000)

        # print(f"{month+4}/{(day % 30)+1}", self.s, self.s_max)
        # print("MOL_STOCK", self.MOL_stock)
        # print("BLK_STOCK", self.BLK_stock)
        # print("blk_diff: ", blk_diff)
        # print(reward)
        # print()

    else:
        reward = 0

    return reward

def get_score(self):
    score, stock = self.simulator.get_score(self.submission)
    return score

def update_mask(self):
    self.mask[:] = False
    if self.process == 0:
        if self.check_time == 28:
            self.mask[:4] = True
        if self.check_time < 28:
            self.mask[self.process_mode] = True
    if self.process == 1:
        self.mask[4] = True
        if self.process_time > 98:
            self.mask[:4] = True

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모델 변수 설정

input_length = 125

입력 데이터 길이

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output_length_1 = 5
output_length_2 = 12

alpha = 0.01
alpha_decay = 0.01
dropout = 0.3

# 모델 생성
model1 = Sequential()
model1.add(Dense(50, input_dim=input_length, activation='relu'))
# model1.add(Dropout(dropout))
model1.add(Dense(50, activation='relu'))
# model1.add(Dropout(dropout))
model1.add(Dense(50, activation='relu'))
# model1.add(Dropout(dropout))
model1.add(Dense(output_length_1, activation='linear'))

model1.compile(loss='mse', optimizer=Adam(lr=alpha, decay=alpha_decay))

model2 = Sequential()
model2.add(Dense(50, input_dim=input_length, activation='relu'))
# model2.add(Dropout(dropout))
model2.add(Dense(50, activation='relu'))
# model2.add(Dropout(dropout))
model2.add(Dense(50, activation='relu'))
# model2.add(Dropout(dropout))
model2.add(Dense(output_length_2, activation='linear'))

model2.compile(loss='mse', optimizer=Adam(lr=alpha, decay=alpha_decay))

# 학습 변수 설정
EPOCHS = 500
CHECK_EPOCH = 1
THRESHOLD = 90

batch_size = 2000
memory_size = 50000
gamma = 0.98

epsilon = 1

epsilon_min = 0.001
epsilon_decay = 0.95

memory = deque(maxlen=memory_size)

score_history = []

scores = deque(maxlen=CHECK_EPOCH)
avg_scores = []

#%% start train
for e in tf.range(EPOCHS):
    env = Env()
    if e % CHECK_EPOCH == 0:
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print()
print(f'epoch {e} start, epsilon: ', epsilon, ' time: ', datetime.datetime.now())

done = False
i = 0
# before_time = datetime.datetime.now()

states = env.states()
predicts1 = model1.predict(states)
predicts2 = model2.predict(states)

reward_sum = 0
action_dict = defaultdict(int)
out1_dict = defaultdict(int)
mask_dict = defaultdict(int)

while not done:

    # if i % 500 == 0:
    #     print(i, ' STEP! ', datetime.datetime.now())
    #     print('TIME: ', datetime.datetime.now() - before_time)
    #     print('Epsilon: ', epsilon1)
    #     before_time = datetime.datetime.now()

    # action 선택
    if np.random.random() <= epsilon:
        out1 = np.random.rand(output_length_1)
    else:
        out1 = predicts1[i]

    if np.random.random() <= epsilon:
        out2 = np.random.rand(output_length_2)
    else:
        out2 = predicts2[i]

    env.update_mask()

    action1 = np.argmax(out1 * env.mask)
    action2 = np.argmax(out2)

    # print(action1)
    action_dict[action1] += 1
    out1_dict[np.argmax(out1)] += 1
    mask_dict[tuple(env.mask)] += 1

    reward = env.step((action1, action2))
    reward_sum += reward

    done = env.done()

    # memory에 저장
    memory.append((states[i][np.newaxis, :], (action1, action2), reward, states[i + 1][np.newaxis, :]))

    i += 1

epsilon = max(epsilon_min, epsilon_decay * epsilon)

score = env.get_score()
s = env.simulator

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print('부족분 점수: ', 50 * s.F(s.p, 10*s.N))
print('추가분 점수: ', 20 * s.F(s.q, 10*s.N))
print('기타 점수: ', 20*s.F(s.c, s.M)/(1+0.1*s.c_n) + 10*s.F(s.s, s.M)/(1 + 0.1*s.s_n))

scores.append(score)

mean_score = np.average(scores)
avg_scores.append(mean_score)

score_history.append([e, score])

# early-stop 확인 / 현재 상태
if mean_score >= THRESHOLD and e >= CHECK_EPOCH:
    print(f'Ran {e + 1} times. Solved after {e-CHECK_EPOCH} trials!')
    break
if e % CHECK_EPOCH == 0:
    print(f'[Episode {e + 1}] - Mean score over last {CHECK_EPOCH} times:{mean_score}')

# replay
x_batch1, y_batch1 = [], []
x_batch2, y_batch2 = [], []

minibatch = random.sample(memory, min(len(memory), batch_size))

state = minibatch[0][0]
states = np.empty((batch_size, state.shape[1]))
next_states = np.empty((batch_size, state.shape[1]))

for i, (state, actions, reward, next_state, done) in enumerate(minibatch):
    states[i] = np.squeeze(state)
    next_states[i] = np.squeeze(next_state)

y_targets1 = model1.predict(states)
y_targets2 = model2.predict(states)

predicts1 = model1.predict(next_states)
predicts2 = model2.predict(next_states)

for i, (state, actions, reward, next_state, done) in enumerate(minibatch):
    action1, action2 = actions

    y_targets1[i][action1] = reward if done else reward + gamma * np.max(predicts1[i])
    x_batch1.append(state[0])
    y_batch1.append(y_targets1[i])

    y_targets2[i][action2] = reward if done else reward + gamma * np.max(predicts2[i])
    x_batch2.append(state[0])
    y_batch2.append(y_targets2[i])

model1.fit(np.array(x_batch1), np.array(y_batch1), batch_size=len(minibatch), verbose=0)
model2.fit(np.array(x_batch2), np.array(y_batch2), batch_size=len(minibatch), verbose=0)

env.reset()

#%% show graph
score_history = np.array(score_history)

plt.plot(score_history[:,0], score_history[:,1], '-o', label='score')

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plt.legend()
plt.xlim(0, EPOCHS)
plt.ylim(bottom=0)
plt.xlabel('Epochs')
plt.ylabel('Score')
plt.show()

env = Env()
done = False

while not env.done():
    state = env.state()[np.newaxis, :]
    # action 선택
    out1 = model1.predict(state)
    out2 = model2.predict(state)

    action1 = np.argmax(out1 * env.mask)
    action2 = np.argmax(out2)

    reward = env.step((action1, action2))

# 재고 계산
simulator = Simulator()
_, df_stock = simulator.get_score(env.submission)

# PRT 개수 계산
PRTs = df_stock[['PRT_1', 'PRT_2', 'PRT_3', 'PRT_4']].values
PRTs = (PRTs[:-1] - PRTs[1:])[24*23:]
PRTs = np.ceil(PRTs * 1.1)
PAD = np.zeros((24*23+1, 4))
PRTs = np.append(PRTs, PAD, axis=0).astype(int)

# Submission 파일에 PRT 입력
env.submission.loc[:, 'PRT_1':'PRT_4'] = PRTs
env.submission.to_csv('submission_dqn.csv', index=False)

```

epoch 0 start, epsilon: 1 time: 2020-06-29 01:39:04.501759
 부족분 점수: 45.092702705276636
 추가분 점수: 6.783113671755836
 기타 점수: 30.0
 [Episode 1] - Mean score over last 1 times:81.87581637703246

epoch 1 start, epsilon: 0.95 time: 2020-06-29 01:39:19.390025
 부족분 점수: 29.23554483864159
 추가분 점수: 0
 기타 점수: 30.0
 [Episode 2] - Mean score over last 1 times:59.23554483864159

epoch 2 start, epsilon: 0.9025 time: 2020-06-29 01:39:32.308480
 부족분 점수: 25.968814005664377
 추가분 점수: 0
 기타 점수: 30.0
 [Episode 3] - Mean score over last 1 times:55.96881400566438

epoch 3 start, epsilon: 0.8573749999999999 time: 2020-06-29 01:39:44.986575
 부족분 점수: 33.29719549393978

추가분 점수: 0
기타 점수: 30.0
[Episode 4] - Mean score over last 1 times:63.29719549393978

epoch 4 start, epsilon: 0.8145062499999999 time: 2020-06-29 01:39:58.128432
부족분 점수: 39.14572378031528
추가분 점수: 5.584304301917955
기타 점수: 30.0
[Episode 5] - Mean score over last 1 times:74.73002808223323

epoch 5 start, epsilon: 0.7737809374999999 time: 2020-06-29 01:40:11.700101
부족분 점수: 45.059958532547405
추가분 점수: 4.051252763754412
기타 점수: 30.0
[Episode 6] - Mean score over last 1 times:79.11121129630182

epoch 6 start, epsilon: 0.7350918906249998 time: 2020-06-29 01:40:27.008250
부족분 점수: 38.16962578219972
추가분 점수: 5.966505308774002
기타 점수: 30.0
[Episode 7] - Mean score over last 1 times:74.13613109097372

epoch 7 start, epsilon: 0.6983372960937497 time: 2020-06-29 01:40:40.622264
부족분 점수: 46.430584104921444
추가분 점수: 1.833611001624229
기타 점수: 30.0
[Episode 8] - Mean score over last 1 times:78.26419510654567

epoch 8 start, epsilon: 0.6634204312890623 time: 2020-06-29 01:40:53.704303
부족분 점수: 39.53628217775092
추가분 점수: 0
기타 점수: 30.0
[Episode 9] - Mean score over last 1 times:69.53628217775092

epoch 9 start, epsilon: 0.6302494097246091 time: 2020-06-29 01:41:07.731267
부족분 점수: 48.02023635034806
추가분 점수: 0
기타 점수: 30.0
[Episode 10] - Mean score over last 1 times:78.02023635034806

epoch 10 start, epsilon: 0.5987369392383786 time: 2020-06-29 01:41:21.632159
부족분 점수: 26.38519509333556
추가분 점수: 0
기타 점수: 30.0
[Episode 11] - Mean score over last 1 times:56.38519509333556

epoch 11 start, epsilon: 0.5688000922764596 time: 2020-06-29 01:41:36.718247
부족분 점수: 36.95996538337118
추가분 점수: 3.4285608078196472
기타 점수: 30.0
[Episode 12] - Mean score over last 1 times:70.38852619119083

epoch 12 start, epsilon: 0.5403600876626365 time: 2020-06-29 01:41:49.510228
부족분 점수: 10.385811974686977
추가분 점수: 0.137568227906939
기타 점수: 30.0
[Episode 13] - Mean score over last 1 times:40.52338020259391

epoch 13 start, epsilon: 0.5133420832795047 time: 2020-06-29 01:42:02.698250
부족분 점수: 31.56855600917089
추가분 점수: 11.687753584163598

기타 점수: 30.0

[Episode 14] - Mean score over last 1 times:73.25630959333449

epoch 14 start, epsilon: 0.48767497911552943 time: 2020-06-29 01:42:17.594246

부족분 점수: 25.435996562914063

추가분 점수: 12.047303862912251

기타 점수: 30.0

[Episode 15] - Mean score over last 1 times:67.48330042582631

epoch 15 start, epsilon: 0.46329123015975293 time: 2020-06-29 01:42:31.415228

부족분 점수: 28.12568527438471

추가분 점수: 13.170520690255824

기타 점수: 30.0

[Episode 16] - Mean score over last 1 times:71.29620596464054

epoch 16 start, epsilon: 0.44012666865176525 time: 2020-06-29 01:42:44.789218

부족분 점수: 35.08621592752013

추가분 점수: 0

기타 점수: 30.0

[Episode 17] - Mean score over last 1 times:65.08621592752013

epoch 17 start, epsilon: 0.41812033521917696 time: 2020-06-29 01:42:57.442198

부족분 점수: 18.0164530366814

추가분 점수: 5.380182317931679

기타 점수: 30.0

[Episode 18] - Mean score over last 1 times:53.39663535461308

epoch 18 start, epsilon: 0.3972143184582181 time: 2020-06-29 01:43:10.245214

부족분 점수: 32.390117241250074

추가분 점수: 0

기타 점수: 30.0

[Episode 19] - Mean score over last 1 times:62.390117241250074

epoch 19 start, epsilon: 0.37735360253530714 time: 2020-06-29 01:43:22.717199

부족분 점수: 19.4082823694511

추가분 점수: 11.314032238194848

기타 점수: 30.0

[Episode 20] - Mean score over last 1 times:60.72231460764595

epoch 20 start, epsilon: 0.35848592240854177 time: 2020-06-29 01:43:35.863206

부족분 점수: 26.651228248250504

추가분 점수: 14.196804198233961

기타 점수: 30.0

[Episode 21] - Mean score over last 1 times:70.84803244648447

epoch 21 start, epsilon: 0.34056162628811465 time: 2020-06-29 01:43:48.529168

부족분 점수: 30.3592197188213

추가분 점수: 12.036639925925083

기타 점수: 30.0

[Episode 22] - Mean score over last 1 times:72.39585964474638

epoch 22 start, epsilon: 0.3235335449737089 time: 2020-06-29 01:44:03.237190

부족분 점수: 30.596864964733616

추가분 점수: 1.7580952620870183

기타 점수: 30.0

[Episode 23] - Mean score over last 1 times:62.35496022682064

epoch 23 start, epsilon: 0.30735686772502346 time: 2020-06-29 01:44:17.415179

부족분 점수: 13.681903042103688

추가분 점수: 0

기타 점수: 30.0

[Episode 24] - Mean score over last 1 times:43.681903042103684

epoch 24 start, epsilon: 0.2919890243387723 time: 2020-06-29 01:44:31.123686
부족분 점수: 11.27890133677083
추가분 점수: 0
기타 점수: 30.0

[Episode 25] - Mean score over last 1 times:41.27890133677083

epoch 25 start, epsilon: 0.27738957312183365 time: 2020-06-29 01:44:45.334200
부족분 점수: 20.285750010061186
추가분 점수: 14.265088785754465
기타 점수: 30.0

[Episode 26] - Mean score over last 1 times:64.55083879581565

epoch 26 start, epsilon: 0.263520094465742 time: 2020-06-29 01:44:59.448504
부족분 점수: 13.749806072533326
추가분 점수: 16.131228604616226
기타 점수: 30.0

[Episode 27] - Mean score over last 1 times:59.88103467714955

epoch 27 start, epsilon: 0.25034408974245487 time: 2020-06-29 01:45:12.796075
부족분 점수: 29.211969402930738
추가분 점수: 0
기타 점수: 30.0

[Episode 28] - Mean score over last 1 times:59.211969402930734

epoch 28 start, epsilon: 0.2378268852553321 time: 2020-06-29 01:45:25.996291
부족분 점수: 31.00829072561283
추가분 점수: 9.149299725997771
기타 점수: 30.0

[Episode 29] - Mean score over last 1 times:70.1575904516106

epoch 29 start, epsilon: 0.2259355409925655 time: 2020-06-29 01:45:39.075315
부족분 점수: 30.68462309563228
추가분 점수: 0
기타 점수: 30.0

[Episode 30] - Mean score over last 1 times:60.684623095632276

epoch 30 start, epsilon: 0.2146387639429372 time: 2020-06-29 01:45:51.119109
부족분 점수: 19.171222362071873
추가분 점수: 6.493956682517772
기타 점수: 30.0

[Episode 31] - Mean score over last 1 times:55.66517904458965

epoch 31 start, epsilon: 0.20390682574579033 time: 2020-06-29 01:46:03.552859
부족분 점수: 12.661108795075272
추가분 점수: 6.16313808280772
기타 점수: 30.0

[Episode 32] - Mean score over last 1 times:48.82424687788299

epoch 32 start, epsilon: 0.1937114844585008 time: 2020-06-29 01:46:16.478294
부족분 점수: 19.89113334437248
추가분 점수: 0
기타 점수: 30.0

[Episode 33] - Mean score over last 1 times:49.89113334437248

epoch 33 start, epsilon: 0.18402591023557577 time: 2020-06-29 01:46:29.931938
부족분 점수: 47.34631805087612
추가분 점수: 0
기타 점수: 30.0

[Episode 34] - Mean score over last 1 times:77.34631805087612

epoch 34 start, epsilon: 0.17482461472379698 time: 2020-06-29 01:46:42.847400
부족분 점수: 28.98139770936716
추가분 점수: 0
기타 점수: 30.0
[Episode 35] - Mean score over last 1 times:58.98139770936716

epoch 35 start, epsilon: 0.16608338398760714 time: 2020-06-29 01:46:55.709056
부족분 점수: 12.017433964049456
추가분 점수: 14.906355997681167
기타 점수: 30.0
[Episode 36] - Mean score over last 1 times:56.92378996173062

epoch 36 start, epsilon: 0.15777921478822676 time: 2020-06-29 01:47:10.767955
부족분 점수: 11.016299737979029
추가분 점수: 15.299456880208584
기타 점수: 30.0
[Episode 37] - Mean score over last 1 times:56.31575661818761

epoch 37 start, epsilon: 0.14989025404881542 time: 2020-06-29 01:47:25.077953
부족분 점수: 7.7590801832088445
추가분 점수: 15.231176593653679
기타 점수: 30.0
[Episode 38] - Mean score over last 1 times:52.99025677686252

epoch 38 start, epsilon: 0.14239574134637464 time: 2020-06-29 01:47:38.862920
부족분 점수: 7.073919466876882
추가분 점수: 15.308195827879043
기타 점수: 30.0
[Episode 39] - Mean score over last 1 times:52.38211529475593

epoch 39 start, epsilon: 0.1352759542790559 time: 2020-06-29 01:47:52.082033
부족분 점수: 21.322966265376337
추가분 점수: 15.39012062058018
기타 점수: 30.0
[Episode 40] - Mean score over last 1 times:66.71308688595651

epoch 40 start, epsilon: 0.1285121565651031 time: 2020-06-29 01:48:05.646062
부족분 점수: 11.417326378467152
추가분 점수: 9.264275596044708
기타 점수: 30.0
[Episode 41] - Mean score over last 1 times:50.681601974511864

epoch 41 start, epsilon: 0.12208654873684793 time: 2020-06-29 01:48:18.412054
부족분 점수: 27.98504523540567
추가분 점수: 10.772398737605155
기타 점수: 30.0
[Episode 42] - Mean score over last 1 times:68.75744397301082

epoch 42 start, epsilon: 0.11598222130000553 time: 2020-06-29 01:48:31.811465
부족분 점수: 24.921508913904805
추가분 점수: 2.4366825669268644
기타 점수: 30.0
[Episode 43] - Mean score over last 1 times:57.35819148083167

epoch 43 start, epsilon: 0.11018311023500525 time: 2020-06-29 01:48:45.086907
부족분 점수: 30.597075404836065
추가분 점수: 0
기타 점수: 30.0
[Episode 44] - Mean score over last 1 times:60.59707540483606

epoch 44 start, epsilon: 0.10467395472325498 time: 2020-06-29 01:49:01.325542
부족분 점수: 33.26199977081997
추가분 점수: 0
기타 점수: 30.0
[Episode 45] - Mean score over last 1 times:63.26199977081997

epoch 45 start, epsilon: 0.09944025698709223 time: 2020-06-29 01:49:15.625532
부족분 점수: 43.19476031793966
추가분 점수: 0
기타 점수: 30.0
[Episode 46] - Mean score over last 1 times:73.19476031793965

epoch 46 start, epsilon: 0.09446824413773762 time: 2020-06-29 01:49:31.238474
부족분 점수: 30.319656979560893
추가분 점수: 0
기타 점수: 30.0
[Episode 47] - Mean score over last 1 times:60.31965697956089

epoch 47 start, epsilon: 0.08974483193085074 time: 2020-06-29 01:49:44.859509
부족분 점수: 24.2109064500045
추가분 점수: 0
기타 점수: 30.0
[Episode 48] - Mean score over last 1 times:54.2109064500045

epoch 48 start, epsilon: 0.0852575903343082 time: 2020-06-29 01:49:57.166528
부족분 점수: 34.76850052671468
추가분 점수: 0
기타 점수: 30.0
[Episode 49] - Mean score over last 1 times:64.76850052671469

epoch 49 start, epsilon: 0.08099471081759278 time: 2020-06-29 01:50:10.419546
부족분 점수: 33.76892079249592
추가분 점수: 0
기타 점수: 30.0
[Episode 50] - Mean score over last 1 times:63.76892079249592

epoch 50 start, epsilon: 0.07694497527671314 time: 2020-06-29 01:50:23.859040
부족분 점수: 39.17451260075396
추가분 점수: 1.1334961351215922
기타 점수: 30.0
[Episode 51] - Mean score over last 1 times:70.30800873587555

epoch 51 start, epsilon: 0.07309772651287748 time: 2020-06-29 01:50:39.780069
부족분 점수: 30.64756566883241
추가분 점수: 0
기타 점수: 30.0
[Episode 52] - Mean score over last 1 times:60.647565668832414

epoch 52 start, epsilon: 0.0694428401872336 time: 2020-06-29 01:50:54.600479
부족분 점수: 26.414698181275252
추가분 점수: 0
기타 점수: 30.0
[Episode 53] - Mean score over last 1 times:56.414698181275256

epoch 53 start, epsilon: 0.0659706981778719 time: 2020-06-29 01:51:07.359531
부족분 점수: 36.14143325991995
추가분 점수: 2.790090452378633
기타 점수: 30.0
[Episode 54] - Mean score over last 1 times:68.93152371229858

epoch 54 start, epsilon: 0.0626721632689783 time: 2020-06-29 01:51:20.785504
부족분 점수: 37.452802278774456
추가분 점수: 0
기타 점수: 30.0
[Episode 55] - Mean score over last 1 times:67.45280227877446

epoch 55 start, epsilon: 0.059538555105529384 time: 2020-06-29 01:51:34.226462
부족분 점수: 33.809179366547646
추가분 점수: 0
기타 점수: 30.0
[Episode 56] - Mean score over last 1 times:63.809179366547646

epoch 56 start, epsilon: 0.05656162735025291 time: 2020-06-29 01:51:47.998789
부족분 점수: 27.726468111565815
추가분 점수: 8.088088076402354
기타 점수: 30.0
[Episode 57] - Mean score over last 1 times:65.81455618796817

epoch 57 start, epsilon: 0.053733545982740265 time: 2020-06-29 01:52:00.352467
부족분 점수: 24.763224163562036
추가분 점수: 9.49567184615569
기타 점수: 30.0
[Episode 58] - Mean score over last 1 times:64.25889600971772

epoch 58 start, epsilon: 0.05104686868360325 time: 2020-06-29 01:52:14.992086
부족분 점수: 26.804370272585988
추가분 점수: 12.638527496841094
기타 점수: 30.0
[Episode 59] - Mean score over last 1 times:69.44289776942708

epoch 59 start, epsilon: 0.04849452524942309 time: 2020-06-29 01:52:28.569076
부족분 점수: 24.501350656803528
추가분 점수: 12.517600319254532
기타 점수: 30.0
[Episode 60] - Mean score over last 1 times:67.01895097605805

epoch 60 start, epsilon: 0.04606979898695193 time: 2020-06-29 01:52:42.509083
부족분 점수: 22.061376007923606
추가분 점수: 8.731065843789544
기타 점수: 30.0
[Episode 61] - Mean score over last 1 times:60.79244185171315

epoch 61 start, epsilon: 0.04376630903760433 time: 2020-06-29 01:52:56.616080
부족분 점수: 22.649468538897473
추가분 점수: 7.812023226443074
기타 점수: 30.0
[Episode 62] - Mean score over last 1 times:60.46149176534055

epoch 62 start, epsilon: 0.041577993585724116 time: 2020-06-29 01:53:13.312039
부족분 점수: 37.41923631440427
추가분 점수: 0
기타 점수: 30.0
[Episode 63] - Mean score over last 1 times:67.41923631440427

epoch 63 start, epsilon: 0.03949909390643791 time: 2020-06-29 01:53:26.821039
부족분 점수: 43.150904293377465
추가분 점수: 0
기타 점수: 30.0
[Episode 64] - Mean score over last 1 times:73.15090429337747

epoch 64 start, epsilon: 0.03752413921111601 time: 2020-06-29 01:53:40.013017

부족분 점수: 46.78294685573302

추가분 점수: 0

기타 점수: 30.0

[Episode 65] - Mean score over last 1 times:76.78294685573303

epoch 65 start, epsilon: 0.03564793225056021 time: 2020-06-29 01:53:54.465035

부족분 점수: 36.65439713826038

추가분 점수: 0

기타 점수: 30.0

[Episode 66] - Mean score over last 1 times:66.65439713826038

epoch 66 start, epsilon: 0.0338655356380322 time: 2020-06-29 01:54:09.688055

부족분 점수: 26.212572766961706

추가분 점수: 0

기타 점수: 30.0

[Episode 67] - Mean score over last 1 times:56.212572766961706

epoch 67 start, epsilon: 0.032172258856130585 time: 2020-06-29 01:54:23.663039

부족분 점수: 36.87410428551284

추가분 점수: 0.7001597194295806

기타 점수: 30.0

[Episode 68] - Mean score over last 1 times:67.57426400494242

epoch 68 start, epsilon: 0.030563645913324056 time: 2020-06-29 01:54:38.349017

부족분 점수: 23.947154342915372

추가분 점수: 2.670005035201868

기타 점수: 30.0

[Episode 69] - Mean score over last 1 times:56.617159378117236

epoch 69 start, epsilon: 0.029035463617657853 time: 2020-06-29 01:54:52.406045

부족분 점수: 24.448705301831016

추가분 점수: 5.539394233572539

기타 점수: 30.0

[Episode 70] - Mean score over last 1 times:59.988099535403556

epoch 70 start, epsilon: 0.027583690436774957 time: 2020-06-29 01:55:05.760985

부족분 점수: 21.135487174981403

추가분 점수: 8.356486147972264

기타 점수: 30.0

[Episode 71] - Mean score over last 1 times:59.49197332295367

epoch 71 start, epsilon: 0.02620450591493621 time: 2020-06-29 01:55:20.779009

부족분 점수: 17.36820382153082

추가분 점수: 4.0859234618594975

기타 점수: 30.0

[Episode 72] - Mean score over last 1 times:51.45412728339032

epoch 72 start, epsilon: 0.0248942806191894 time: 2020-06-29 01:55:35.703309

부족분 점수: 16.873780177033886

추가분 점수: 3.7591274938304187

기타 점수: 30.0

[Episode 73] - Mean score over last 1 times:50.632907670864306

epoch 73 start, epsilon: 0.023649566588229927 time: 2020-06-29 01:55:49.378393

부족분 점수: 17.193209819841766

추가분 점수: 3.5104124841056272

기타 점수: 30.0

[Episode 74] - Mean score over last 1 times:50.70362230394739

epoch 74 start, epsilon: 0.022467088258818428 time: 2020-06-29 01:56:04.031034

부족분 점수: 20.123251849492007

추가분 점수: 1.9858891462982675

기타 점수: 30.0

[Episode 75] - Mean score over last 1 times:52.10914099579027

epoch 75 start, epsilon: 0.021343733845877507 time: 2020-06-29 01:56:16.092055

부족분 점수: 16.90339232517266

추가분 점수: 0

기타 점수: 30.0

[Episode 76] - Mean score over last 1 times:46.90339232517266

epoch 76 start, epsilon: 0.02027654715358363 time: 2020-06-29 01:56:30.733456

부족분 점수: 17.50289316739389

추가분 점수: 0

기타 점수: 30.0

[Episode 77] - Mean score over last 1 times:47.50289316739389

epoch 77 start, epsilon: 0.019262719795904448 time: 2020-06-29 01:56:44.651286

부족분 점수: 17.30899181372641

추가분 점수: 0

기타 점수: 30.0

[Episode 78] - Mean score over last 1 times:47.30899181372641

epoch 78 start, epsilon: 0.018299583806109226 time: 2020-06-29 01:56:57.659311

부족분 점수: 16.95004551343238

추가분 점수: 0

기타 점수: 30.0

[Episode 79] - Mean score over last 1 times:46.95004551343238

epoch 79 start, epsilon: 0.017384604615803764 time: 2020-06-29 01:57:12.289301

부족분 점수: 22.064933520896396

추가분 점수: 0.9412786094855341

기타 점수: 30.0

[Episode 80] - Mean score over last 1 times:53.006212130381925

epoch 80 start, epsilon: 0.016515374385013576 time: 2020-06-29 01:57:26.956278

부족분 점수: 17.420099579642056

추가분 점수: 1.6732574868290606

기타 점수: 30.0

[Episode 81] - Mean score over last 1 times:49.093357066471114

epoch 81 start, epsilon: 0.015689605665762895 time: 2020-06-29 01:57:40.361283

부족분 점수: 26.11284873534715

추가분 점수: 1.7043006276644856

기타 점수: 30.0

[Episode 82] - Mean score over last 1 times:57.81714936301164

epoch 82 start, epsilon: 0.01490512538247475 time: 2020-06-29 01:57:54.203245

부족분 점수: 20.836308935901172

추가분 점수: 0.4948457535491424

기타 점수: 30.0

[Episode 83] - Mean score over last 1 times:51.331154689450315

epoch 83 start, epsilon: 0.014159869113351011 time: 2020-06-29 01:58:07.861263

부족분 점수: 23.974574534658565

추가분 점수: 0

기타 점수: 30.0

[Episode 84] - Mean score over last 1 times:53.974574534658565

epoch 84 start, epsilon: 0.01345187565768346 time: 2020-06-29 01:58:21.632227

부족분 점수: 22.745118941667542

추가분 점수: 0
기타 점수: 30.0
[Episode 85] - Mean score over last 1 times:52.74511894166754

epoch 85 start, epsilon: 0.012779281874799287 time: 2020-06-29 01:58:35.027245
부족분 점수: 20.520174139952807
추가분 점수: 0
기타 점수: 30.0
[Episode 86] - Mean score over last 1 times:50.52017413995281

epoch 86 start, epsilon: 0.012140317781059323 time: 2020-06-29 01:58:49.502247
부족분 점수: 19.582732606203894
추가분 점수: 0
기타 점수: 30.0
[Episode 87] - Mean score over last 1 times:49.58273260620389

epoch 87 start, epsilon: 0.011533301892006355 time: 2020-06-29 01:59:03.223222
부족분 점수: 22.098084749298252
추가분 점수: 0
기타 점수: 30.0
[Episode 88] - Mean score over last 1 times:52.09808474929825

epoch 88 start, epsilon: 0.010956636797406038 time: 2020-06-29 01:59:17.076493
부족분 점수: 21.52515004993728
추가분 점수: 0
기타 점수: 30.0
[Episode 89] - Mean score over last 1 times:51.52515004993728

epoch 89 start, epsilon: 0.010408804957535735 time: 2020-06-29 01:59:30.570211
부족분 점수: 20.4912378578365
추가분 점수: 0
기타 점수: 30.0
[Episode 90] - Mean score over last 1 times:50.491237857836495

epoch 90 start, epsilon: 0.009888364709658948 time: 2020-06-29 01:59:45.169205
부족분 점수: 27.014630656115372
추가분 점수: 5.51152643419538
기타 점수: 30.0
[Episode 91] - Mean score over last 1 times:62.526157090310754

epoch 91 start, epsilon: 0.009393946474176 time: 2020-06-29 01:59:59.505533
부족분 점수: 19.957143949939216
추가분 점수: 0.8585182006111669
기타 점수: 30.0
[Episode 92] - Mean score over last 1 times:50.81566215055038

epoch 92 start, epsilon: 0.0089242491504672 time: 2020-06-29 02:00:13.728437
부족분 점수: 22.32476560505523
추가분 점수: 3.171983018558975
기타 점수: 30.0
[Episode 93] - Mean score over last 1 times:55.49674862361421

epoch 93 start, epsilon: 0.008478036692943839 time: 2020-06-29 02:00:30.638712
부족분 점수: 23.634463391563287
추가분 점수: 0
기타 점수: 30.0
[Episode 94] - Mean score over last 1 times:53.63446339156329

epoch 94 start, epsilon: 0.008054134858296647 time: 2020-06-29 02:00:45.743361
부족분 점수: 22.69352425114813
추가분 점수: 0

기타 점수: 30.0

[Episode 95] - Mean score over last 1 times:52.69352425114813

epoch 95 start, epsilon: 0.0076514281153818135 time: 2020-06-29 02:01:02.556356

부족분 점수: 25.838086156328423

추가분 점수: 0

기타 점수: 30.0

[Episode 96] - Mean score over last 1 times:55.83808615632842

epoch 96 start, epsilon: 0.0072688567096127225 time: 2020-06-29 02:01:20.209325

부족분 점수: 31.473374104439124

추가분 점수: 0

기타 점수: 30.0

[Episode 97] - Mean score over last 1 times:61.473374104439124

epoch 97 start, epsilon: 0.006905413874132086 time: 2020-06-29 02:01:37.266334

부족분 점수: 32.020913138006

추가분 점수: 0

기타 점수: 30.0

[Episode 98] - Mean score over last 1 times:62.020913138006

epoch 98 start, epsilon: 0.006560143180425482 time: 2020-06-29 02:01:52.117357

부족분 점수: 31.286807433174513

추가분 점수: 0

기타 점수: 30.0

[Episode 99] - Mean score over last 1 times:61.286807433174516

epoch 99 start, epsilon: 0.0062321360214042075 time: 2020-06-29 02:02:09.423305

부족분 점수: 28.63470762496686

추가분 점수: 0

기타 점수: 30.0

[Episode 100] - Mean score over last 1 times:58.634707624966865

epoch 100 start, epsilon: 0.005920529220333997 time: 2020-06-29 02:02:27.161323

부족분 점수: 25.109110889031093

추가분 점수: 0

기타 점수: 30.0

[Episode 101] - Mean score over last 1 times:55.10911088903109

epoch 101 start, epsilon: 0.0056245027593172965 time: 2020-06-29 02:02:43.07126

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부족분 점수: 22.827829582225707

추가분 점수: 0

기타 점수: 30.0

[Episode 102] - Mean score over last 1 times:52.827829582225704

epoch 102 start, epsilon: 0.005343277621351432 time: 2020-06-29 02:02:57.761063

부족분 점수: 27.370985624636912

추가분 점수: 2.8036470959419457

기타 점수: 30.0

[Episode 103] - Mean score over last 1 times:60.174632720578856

epoch 103 start, epsilon: 0.0050761137402838595 time: 2020-06-29 02:03:12.01893

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부족분 점수: 16.629628184596214

추가분 점수: 6.484156625192046

기타 점수: 30.0

[Episode 104] - Mean score over last 1 times:53.11378480978826

epoch 104 start, epsilon: 0.004822308053269666 time: 2020-06-29 02:03:25.007202

부족분 점수: 17.429597033316817

추가분 점수: 8.729559891406762

기타 점수: 30.0

[Episode 105] - Mean score over last 1 times:56.159156924723575

epoch 105 start, epsilon: 0.004581192650606183 time: 2020-06-29 02:03:41.270753

부족분 점수: 17.767889482388004

추가분 점수: 7.74970592147727

기타 점수: 30.0

[Episode 106] - Mean score over last 1 times:55.51759540386527

epoch 106 start, epsilon: 0.0043521330180758735 time: 2020-06-29 02:03:53.118072

부족분 점수: 18.714633390300644

추가분 점수: 6.1778111341554105

기타 점수: 30.0

[Episode 107] - Mean score over last 1 times:54.89244452445605

epoch 107 start, epsilon: 0.0041345263671720795 time: 2020-06-29 02:04:05.526888

부족분 점수: 25.503133099831864

추가분 점수: 6.0469450394966895

기타 점수: 30.0

[Episode 108] - Mean score over last 1 times:61.550078139328555

epoch 108 start, epsilon: 0.003927800048813475 time: 2020-06-29 02:04:18.145146

부족분 점수: 30.94535991862573

추가분 점수: 0

기타 점수: 30.0

[Episode 109] - Mean score over last 1 times:60.945359918625726

epoch 109 start, epsilon: 0.0037314100463728015 time: 2020-06-29 02:04:31.521374

부족분 점수: 27.28311382536175

추가분 점수: 0

기타 점수: 30.0

[Episode 110] - Mean score over last 1 times:57.28311382536175

epoch 110 start, epsilon: 0.0035448395440541612 time: 2020-06-29 02:04:44.264297

부족분 점수: 15.614657137774978

추가분 점수: 0

기타 점수: 30.0

[Episode 111] - Mean score over last 1 times:45.61465713777498

epoch 111 start, epsilon: 0.003367597566851453 time: 2020-06-29 02:04:57.981615

부족분 점수: 15.641937548136253

추가분 점수: 0

기타 점수: 30.0

[Episode 112] - Mean score over last 1 times:45.641937548136255

epoch 112 start, epsilon: 0.00319921768850888 time: 2020-06-29 02:05:12.671332

부족분 점수: 17.13821583044119

추가분 점수: 0

기타 점수: 30.0

[Episode 113] - Mean score over last 1 times:47.13821583044119

epoch 113 start, epsilon: 0.003039256804083436 time: 2020-06-29 02:05:25.477088

부족분 점수: 16.191984966281964

추가분 점수: 0

기타 점수: 30.0

[Episode 114] - Mean score over last 1 times:46.191984966281964

epoch 114 start, epsilon: 0.0028872939638792637 time: 2020-06-29 02:05:38.533173

부족분 점수: 16.3393345115931

추가분 점수: 0

기타 점수: 30.0

[Episode 115] - Mean score over last 1 times:46.3393345115931

epoch 115 start, epsilon: 0.0027429292656853004 time: 2020-06-29 02:05:51.739372

부족분 점수: 15.735477405645264

추가분 점수: 0

기타 점수: 30.0

[Episode 116] - Mean score over last 1 times:45.73547740564526

epoch 116 start, epsilon: 0.0026057828024010354 time: 2020-06-29 02:06:07.094504

부족분 점수: 15.618256124344605

추가분 점수: 0

기타 점수: 30.0

[Episode 117] - Mean score over last 1 times:45.618256124344605

epoch 117 start, epsilon: 0.0024754936622809836 time: 2020-06-29 02:06:20.958508

부족분 점수: 14.239638436254925

추가분 점수: 0

기타 점수: 30.0

[Episode 118] - Mean score over last 1 times:44.23963843625492

epoch 118 start, epsilon: 0.002351718979166934 time: 2020-06-29 02:06:34.313498

부족분 점수: 26.089594335996964

추가분 점수: 0.24734361612284594

기타 점수: 30.0

[Episode 119] - Mean score over last 1 times:56.33693795211981

epoch 119 start, epsilon: 0.0022341330302085875 time: 2020-06-29 02:06:50.070332

부족분 점수: 12.667637046428615

추가분 점수: 0

기타 점수: 30.0

[Episode 120] - Mean score over last 1 times:42.66763704642862

epoch 120 start, epsilon: 0.002122426378698158 time: 2020-06-29 02:07:04.731791

부족분 점수: 12.621690445374206

추가분 점수: 1.78728530117358

기타 점수: 30.0

[Episode 121] - Mean score over last 1 times:44.40897574654778

epoch 121 start, epsilon: 0.0020163050597632503 time: 2020-06-29 02:07:22.550489

부족분 점수: 12.621690445374206

추가분 점수: 1.3708535235507058

기타 점수: 30.0

[Episode 122] - Mean score over last 1 times:43.99254396892491

epoch 122 start, epsilon: 0.0019154898067750877 time: 2020-06-29 02:07:36.358470

부족분 점수: 12.758272216100174

추가분 점수: 5.845854621832991

기타 점수: 30.0

[Episode 123] - Mean score over last 1 times:48.604126837933165

epoch 123 start, epsilon: 0.0018197153164363333 time: 2020-06-29 02:07:52.032457
부족분 점수: 13.056708538614837
추가분 점수: 5.854260551881472
기타 점수: 30.0
[Episode 124] - Mean score over last 1 times:48.91096909049631

epoch 124 start, epsilon: 0.0017287295506145165 time: 2020-06-29 02:08:06.793489
부족분 점수: 23.874317490521747
추가분 점수: 4.67646569952965
기타 점수: 30.0
[Episode 125] - Mean score over last 1 times:58.55078319047471

epoch 125 start, epsilon: 0.0016422930730837905 time: 2020-06-29 02:08:22.090467
부족분 점수: 23.865331544541263
추가분 점수: 4.349203384368385
기타 점수: 30.0
[Episode 126] - Mean score over last 1 times:58.21453492890965

epoch 126 start, epsilon: 0.0015601784194296008 time: 2020-06-29 02:08:37.586461
부족분 점수: 24.26786966722507
추가분 점수: 4.181415957749772
기타 점수: 30.0
[Episode 127] - Mean score over last 1 times:58.44928562497484

epoch 127 start, epsilon: 0.0014821694984581207 time: 2020-06-29 02:08:52.546475
부족분 점수: 23.424608527647372
추가분 점수: 5.343549765090476
기타 점수: 30.0
[Episode 128] - Mean score over last 1 times:58.76815829273785

epoch 128 start, epsilon: 0.0014080610235352145 time: 2020-06-29 02:09:06.515503
부족분 점수: 23.424608527647372
추가분 점수: 5.343549765090476
기타 점수: 30.0
[Episode 129] - Mean score over last 1 times:58.76815829273785

epoch 129 start, epsilon: 0.0013376579723584536 time: 2020-06-29 02:09:21.842705
부족분 점수: 23.424608527647372
추가분 점수: 5.343549765090476
기타 점수: 30.0
[Episode 130] - Mean score over last 1 times:58.76815829273785

epoch 130 start, epsilon: 0.0012707750737405309 time: 2020-06-29 02:09:39.560711
부족분 점수: 23.25274194237136
추가분 점수: 5.50243787946421
기타 점수: 30.0
[Episode 131] - Mean score over last 1 times:58.75517982183557

epoch 131 start, epsilon: 0.0012072363200535043 time: 2020-06-29 02:09:56.144736
부족분 점수: 23.25274194237136
추가분 점수: 5.50243787946421
기타 점수: 30.0
[Episode 132] - Mean score over last 1 times:58.75517982183557

epoch 132 start, epsilon: 0.001146874504050829 time: 2020-06-29 02:10:10.378809
부족분 점수: 23.02085845430055
추가분 점수: 5.50243787946421
기타 점수: 30.0
[Episode 133] - Mean score over last 1 times:58.52329633376476

epoch 133 start, epsilon: 0.0010895307788482875 time: 2020-06-29 02:10:27.666702
부족분 점수: 21.417181988907807
추가분 점수: 3.9299839666146763
기타 점수: 30.0
[Episode 134] - Mean score over last 1 times:55.347165955522485

epoch 134 start, epsilon: 0.001035054239905873 time: 2020-06-29 02:10:41.940677
부족분 점수: 21.954352623266445
추가분 점수: 0
기타 점수: 30.0
[Episode 135] - Mean score over last 1 times:51.954352623266445

epoch 135 start, epsilon: 0.001 time: 2020-06-29 02:10:56.070695
부족분 점수: 26.583480359794205
추가분 점수: 0
기타 점수: 30.0
[Episode 136] - Mean score over last 1 times:56.58348035979421

epoch 136 start, epsilon: 0.001 time: 2020-06-29 02:11:12.000649
부족분 점수: 26.57764947929131
추가분 점수: 0
기타 점수: 30.0
[Episode 137] - Mean score over last 1 times:56.57764947929131

epoch 137 start, epsilon: 0.001 time: 2020-06-29 02:11:26.809502
부족분 점수: 25.937670406561065
추가분 점수: 0
기타 점수: 30.0
[Episode 138] - Mean score over last 1 times:55.93767040656107

epoch 138 start, epsilon: 0.001 time: 2020-06-29 02:11:41.444662
부족분 점수: 26.901602816272273
추가분 점수: 0
기타 점수: 30.0
[Episode 139] - Mean score over last 1 times:56.90160281627227

epoch 139 start, epsilon: 0.001 time: 2020-06-29 02:11:55.014051
부족분 점수: 26.94096279572594
추가분 점수: 0
기타 점수: 30.0
[Episode 140] - Mean score over last 1 times:56.94096279572594

epoch 140 start, epsilon: 0.001 time: 2020-06-29 02:12:11.150214
부족분 점수: 30.39054764502165
추가분 점수: 0
기타 점수: 30.0
[Episode 141] - Mean score over last 1 times:60.39054764502165

epoch 141 start, epsilon: 0.001 time: 2020-06-29 02:12:30.294218
부족분 점수: 30.043909786632174
추가분 점수: 0
기타 점수: 30.0
[Episode 142] - Mean score over last 1 times:60.04390978663217

epoch 142 start, epsilon: 0.001 time: 2020-06-29 02:12:45.818149
부족분 점수: 30.05072988922248
추가분 점수: 0
기타 점수: 30.0
[Episode 143] - Mean score over last 1 times:60.05072988922248

epoch 143 start, epsilon: 0.001 time: 2020-06-29 02:12:59.397233

부족분 점수: 27.892187388155694

추가분 점수: 0

기타 점수: 30.0

[Episode 144] - Mean score over last 1 times:57.89218738815569

epoch 144 start, epsilon: 0.001 time: 2020-06-29 02:13:14.013263

부족분 점수: 28.516057808664176

추가분 점수: 0

기타 점수: 30.0

[Episode 145] - Mean score over last 1 times:58.51605780866417

epoch 145 start, epsilon: 0.001 time: 2020-06-29 02:13:31.964214

부족분 점수: 28.390423531442977

추가분 점수: 0

기타 점수: 30.0

[Episode 146] - Mean score over last 1 times:58.39042353144298

epoch 146 start, epsilon: 0.001 time: 2020-06-29 02:13:47.701153

부족분 점수: 26.587543236224697

추가분 점수: 0

기타 점수: 30.0

[Episode 147] - Mean score over last 1 times:56.5875432362247

epoch 147 start, epsilon: 0.001 time: 2020-06-29 02:14:04.473057

부족분 점수: 27.709995413327405

추가분 점수: 0

기타 점수: 30.0

[Episode 148] - Mean score over last 1 times:57.709995413327405

epoch 148 start, epsilon: 0.001 time: 2020-06-29 02:14:19.834142

부족분 점수: 31.658632053314772

추가분 점수: 0

기타 점수: 30.0

[Episode 149] - Mean score over last 1 times:61.658632053314776

epoch 149 start, epsilon: 0.001 time: 2020-06-29 02:14:35.632039

부족분 점수: 32.229585236382604

추가분 점수: 0

기타 점수: 30.0

[Episode 150] - Mean score over last 1 times:62.229585236382604

epoch 150 start, epsilon: 0.001 time: 2020-06-29 02:14:49.961214

부족분 점수: 32.16725042034258

추가분 점수: 0

기타 점수: 30.0

[Episode 151] - Mean score over last 1 times:62.16725042034258

epoch 151 start, epsilon: 0.001 time: 2020-06-29 02:15:04.623157

부족분 점수: 31.217979695141416

추가분 점수: 0

기타 점수: 30.0

[Episode 152] - Mean score over last 1 times:61.217979695141416

epoch 152 start, epsilon: 0.001 time: 2020-06-29 02:15:20.316833

부족분 점수: 31.675682309790567

추가분 점수: 0

기타 점수: 30.0

[Episode 153] - Mean score over last 1 times:61.67568230979057

epoch 153 start, epsilon: 0.001 time: 2020-06-29 02:15:34.666911

부족분 점수: 32.52223676016863

추가분 점수: 0
기타 점수: 30.0
[Episode 154] - Mean score over last 1 times:62.52223676016863

epoch 154 start, epsilon: 0.001 time: 2020-06-29 02:15:49.373833
부족분 점수: 30.98253715803867
추가분 점수: 0
기타 점수: 30.0
[Episode 155] - Mean score over last 1 times:60.98253715803867

epoch 155 start, epsilon: 0.001 time: 2020-06-29 02:16:04.276799
부족분 점수: 31.37862383232624
추가분 점수: 0
기타 점수: 30.0
[Episode 156] - Mean score over last 1 times:61.37862383232624

epoch 156 start, epsilon: 0.001 time: 2020-06-29 02:16:18.317322
부족분 점수: 27.9947500570646
추가분 점수: 1.6464673865459045
기타 점수: 30.0
[Episode 157] - Mean score over last 1 times:59.6412174436105

epoch 157 start, epsilon: 0.001 time: 2020-06-29 02:16:32.179795
부족분 점수: 25.766137146118854
추가분 점수: 2.986224314403043
기타 점수: 30.0
[Episode 158] - Mean score over last 1 times:58.7523614605219

epoch 158 start, epsilon: 0.001 time: 2020-06-29 02:16:47.871846
부족분 점수: 24.894807597840057
추가분 점수: 3.1204906295784163
기타 점수: 30.0
[Episode 159] - Mean score over last 1 times:58.01529822741847

epoch 159 start, epsilon: 0.001 time: 2020-06-29 02:17:02.536763
부족분 점수: 23.867351462312943
추가분 점수: 3.1343053310775804
기타 점수: 30.0
[Episode 160] - Mean score over last 1 times:57.001656793390524

epoch 160 start, epsilon: 0.001 time: 2020-06-29 02:17:17.492054
부족분 점수: 22.014387958770943
추가분 점수: 3.0135415901837215
기타 점수: 30.0
[Episode 161] - Mean score over last 1 times:55.02792954895466

epoch 161 start, epsilon: 0.001 time: 2020-06-29 02:17:33.035624
부족분 점수: 23.146477370930324
추가분 점수: 3.1928697363477365
기타 점수: 30.0
[Episode 162] - Mean score over last 1 times:56.33934710727806

epoch 162 start, epsilon: 0.001 time: 2020-06-29 02:17:49.850786
부족분 점수: 25.72880169261429
추가분 점수: 3.670272002280741
기타 점수: 30.0
[Episode 163] - Mean score over last 1 times:59.39907369489503

epoch 163 start, epsilon: 0.001 time: 2020-06-29 02:18:06.783782

부족분 점수: 20.064090531639284



추가분 점수: 3.4956288364997135

기타 점수: 30.0

[Episode 164] - Mean score over last 1 times:53.559719368139

epoch 164 start, epsilon: 0.001 time: 2020-06-29 02:18:22.062738

부족분 점수: 16.29022670082453

추가분 점수: 5.800263157652202

기타 점수: 30.0

[Episode 165] - Mean score over last 1 times:52.09048985847673

epoch 165 start, epsilon: 0.001 time: 2020-06-29 02:18:39.150751

부족분 점수: 21.437229096769578

추가분 점수: 3.116064935978591

기타 점수: 30.0

[Episode 166] - Mean score over last 1 times:54.55329403274817

epoch 166 start, epsilon: 0.001 time: 2020-06-29 02:18:56.416633

부족분 점수: 21.076944888962895

추가분 점수: 3.362082011426437

기타 점수: 30.0

[Episode 167] - Mean score over last 1 times:54.43902690038934

epoch 167 start, epsilon: 0.001 time: 2020-06-29 02:19:11.141145

부족분 점수: 18.667894182728983

추가분 점수: 5.269949798515123

기타 점수: 30.0

[Episode 168] - Mean score over last 1 times:53.93784398124411

epoch 168 start, epsilon: 0.001 time: 2020-06-29 02:19:25.882125

부족분 점수: 27.635812973125418

추가분 점수: 0

기타 점수: 30.0

[Episode 169] - Mean score over last 1 times:57.63581297312542

epoch 169 start, epsilon: 0.001 time: 2020-06-29 02:19:41.765986

부족분 점수: 27.816014215305724

추가분 점수: 0

기타 점수: 30.0

[Episode 170] - Mean score over last 1 times:57.81601421530573

epoch 170 start, epsilon: 0.001 time: 2020-06-29 02:19:58.226925

부족분 점수: 24.97479326948038

추가분 점수: 0

기타 점수: 30.0

[Episode 171] - Mean score over last 1 times:54.97479326948038

epoch 171 start, epsilon: 0.001 time: 2020-06-29 02:20:09.914879

부족분 점수: 18.289269428767252

추가분 점수: 0

기타 점수: 30.0

[Episode 172] - Mean score over last 1 times:48.289269428767255

epoch 172 start, epsilon: 0.001 time: 2020-06-29 02:20:22.403150

부족분 점수: 18.289269428767252

추가분 점수: 0

기타 점수: 30.0

[Episode 173] - Mean score over last 1 times:48.289269428767255

epoch 173 start, epsilon: 0.001 time: 2020-06-29 02:20:36.581367

부족분 점수: 33.485935688890265

추가분 점수: 0

기타 점수: 30.0

[Episode 174] - Mean score over last 1 times:63.485935688890265

epoch 174 start, epsilon: 0.001 time: 2020-06-29 02:20:51.857459

부족분 점수: 33.528091295982314

추가분 점수: 0.27678249679040423

기타 점수: 30.0

[Episode 175] - Mean score over last 1 times:63.80487379277272

epoch 175 start, epsilon: 0.001 time: 2020-06-29 02:21:04.886406

부족분 점수: 33.129901756729396

추가분 점수: 5.966591328085951

기타 점수: 30.0

[Episode 176] - Mean score over last 1 times:69.09649308481535

epoch 176 start, epsilon: 0.001 time: 2020-06-29 02:21:19.068548

부족분 점수: 24.983124854266386

추가분 점수: 4.141086417765692

기타 점수: 30.0

[Episode 177] - Mean score over last 1 times:59.12421127203208

epoch 177 start, epsilon: 0.001 time: 2020-06-29 02:21:33.233420

부족분 점수: 22.582855798147083

추가분 점수: 3.9298727559327973

기타 점수: 30.0

[Episode 178] - Mean score over last 1 times:56.512728554079885

epoch 178 start, epsilon: 0.001 time: 2020-06-29 02:21:47.838394

부족분 점수: 22.55921277583398

추가분 점수: 3.946260663706578

기타 점수: 30.0

[Episode 179] - Mean score over last 1 times:56.50547343954056

epoch 179 start, epsilon: 0.001 time: 2020-06-29 02:22:01.414406

부족분 점수: 19.65443891906904

추가분 점수: 3.182894568279826

기타 점수: 30.0

[Episode 180] - Mean score over last 1 times:52.837333487348864

epoch 180 start, epsilon: 0.001 time: 2020-06-29 02:22:17.196708

부족분 점수: 12.363297648631388

추가분 점수: 3.035177290410107

기타 점수: 30.0

[Episode 181] - Mean score over last 1 times:45.39847493904149

epoch 181 start, epsilon: 0.001 time: 2020-06-29 02:22:30.523489

부족분 점수: 12.20188855399386

추가분 점수: 1.7204900765971254

기타 점수: 30.0

[Episode 182] - Mean score over last 1 times:43.922378630590984

epoch 182 start, epsilon: 0.001 time: 2020-06-29 02:22:43.905371

부족분 점수: 12.20188855399386

추가분 점수: 0

기타 점수: 30.0

[Episode 183] - Mean score over last 1 times:42.20188855399386

epoch 183 start, epsilon: 0.001 time: 2020-06-29 02:22:58.126764

부족분 점수: 12.20188855399386

추가분 점수: 0

기타 점수: 30.0

[Episode 184] - Mean score over last 1 times:42.20188855399386

epoch 184 start, epsilon: 0.001 time: 2020-06-29 02:23:12.301397

부족분 점수: 12.20188855399386

추가분 점수: 0

기타 점수: 30.0

[Episode 185] - Mean score over last 1 times:42.20188855399386

epoch 185 start, epsilon: 0.001 time: 2020-06-29 02:23:27.051368

부족분 점수: 12.255085354198341

추가분 점수: 0

기타 점수: 30.0

[Episode 186] - Mean score over last 1 times:42.25508535419834

epoch 186 start, epsilon: 0.001 time: 2020-06-29 02:23:41.478371

부족분 점수: 12.177336184668718

추가분 점수: 0

기타 점수: 30.0

[Episode 187] - Mean score over last 1 times:42.17733618466872

epoch 187 start, epsilon: 0.001 time: 2020-06-29 02:23:56.719210

부족분 점수: 12.177336184668718

추가분 점수: 0

기타 점수: 30.0

[Episode 188] - Mean score over last 1 times:42.17733618466872

epoch 188 start, epsilon: 0.001 time: 2020-06-29 02:24:13.438609

부족분 점수: 11.62763591588909

추가분 점수: 0

기타 점수: 30.0

[Episode 189] - Mean score over last 1 times:41.62763591588909

epoch 189 start, epsilon: 0.001 time: 2020-06-29 02:24:27.588769

부족분 점수: 17.2945728265608

추가분 점수: 0

기타 점수: 30.0

[Episode 190] - Mean score over last 1 times:47.294572826560795

epoch 190 start, epsilon: 0.001 time: 2020-06-29 02:24:39.924787

부족분 점수: 15.395585919007287

추가분 점수: 0

기타 점수: 30.0

[Episode 191] - Mean score over last 1 times:45.39558591900729

epoch 191 start, epsilon: 0.001 time: 2020-06-29 02:24:53.075911

부족분 점수: 24.34375866913378

추가분 점수: 0

기타 점수: 30.0

[Episode 192] - Mean score over last 1 times:54.34375866913378

epoch 192 start, epsilon: 0.001 time: 2020-06-29 02:25:05.707132

부족분 점수: 24.505167763771308

추가분 점수: 0

기타 점수: 30.0

[Episode 193] - Mean score over last 1 times:54.50516776377131

epoch 193 start, epsilon: 0.001 time: 2020-06-29 02:25:18.094550

부족분 점수: 23.59641520661685

추가분 점수: 0

기타 점수: 30.0

[Episode 194] - Mean score over last 1 times:53.596415206616854

epoch 194 start, epsilon: 0.001 time: 2020-06-29 02:25:30.626433
부족분 점수: 12.050179672837835
추가분 점수: 0
기타 점수: 30.0
[Episode 195] - Mean score over last 1 times:42.050179672837835

epoch 195 start, epsilon: 0.001 time: 2020-06-29 02:25:47.098857
부족분 점수: 23.21428823781145
추가분 점수: 0
기타 점수: 30.0
[Episode 196] - Mean score over last 1 times:53.214288237811445

epoch 196 start, epsilon: 0.001 time: 2020-06-29 02:25:59.827864
부족분 점수: 23.177783792302687
추가분 점수: 0
기타 점수: 30.0
[Episode 197] - Mean score over last 1 times:53.17778379230269

epoch 197 start, epsilon: 0.001 time: 2020-06-29 02:26:14.197135
부족분 점수: 23.177783792302687
추가분 점수: 0
기타 점수: 30.0
[Episode 198] - Mean score over last 1 times:53.17778379230269

epoch 198 start, epsilon: 0.001 time: 2020-06-29 02:26:26.347858
부족분 점수: 23.177783792302687
추가분 점수: 0
기타 점수: 30.0
[Episode 199] - Mean score over last 1 times:53.17778379230269

epoch 199 start, epsilon: 0.001 time: 2020-06-29 02:26:38.685751
부족분 점수: 23.22263671924802
추가분 점수: 0
기타 점수: 30.0
[Episode 200] - Mean score over last 1 times:53.222636719248015

epoch 200 start, epsilon: 0.001 time: 2020-06-29 02:26:51.984798
부족분 점수: 21.47145249445252
추가분 점수: 0
기타 점수: 30.0
[Episode 201] - Mean score over last 1 times:51.47145249445252

epoch 201 start, epsilon: 0.001 time: 2020-06-29 02:27:05.064819

In []: