IT426: ARTIFICIAL INTELLIGENCE SYSTEMS
INFORMATION TECHNOLOGY DEPARTMENT

ASSIGNMENT 3

ASSIGNED: MAR. 3RD 2020
DUE: MAR 26TH 2020 @ 12:00 PM

Dress Up! Outfit Synthesis using GA Optimization

RULES:

1. You are allowed to work on this assignment in a group of three.
2. You are NOT allowed to copy online published solutions.
3. Some questions are supposed to encourage you to read more on the topics taught in class.

You are invited to an event but not sure what to wear, which happens 99% of the times ☺ You stared at your wardrobe for a while, then decided to go shopping! You went to your favorite store and found the stock in the table below. Your goal is to optimize your look, which consists of pieces from all categories (top, bottom, shoes, neck, and purse) given a dress code, color pallet, and budget. Since you have a limited budget, you are not sure which piece you should buy and which you should get from your own wardrobe. In the table below, pieces with SAR0.0 prices indicate wardrobe pieces.

Therefore, you decide to go back home and implement a GA algorithm to find the best outfit. The code should work as follows; the user enters a dress code (options include casual, sportswear, business, and evening), color pallet (such as dark and bright), and budget=[SAR 0.0 – SAR∞]. Your GA will then run to find the best pieces from each category that maximize your fitness function and output the items.

Your fitness function includes three parameters; dress code, color pallet, and budget. The dress code and budget are equally important and the color pallet is half important. Your fitness function can be designed as *weighted sum* and importance of factors can be encoded as weights w_i in the fitness function, where $\Sigma\, w_i = 1$. Please note that your fitness function value must be in the range [0,1].

CATEGORY	PIECE	COLOR	DRESS CODE	PRICE
TOP	t-shirt	Dark, bright	casual, sportswear	0.0 SAR
	blouse	bright	Business, evening	200.0 SAR
	bodysuit	dark	casual, evening	150.0 SAR
	sleeveless	dark	casual	110.0 SAR
	tank	bright	casual, sportswear	70.0 SAR
	sweater	dark	casual, business	200.0 SAR
	vest	dark	business	300.0 SAR
	blazer	dark	business	430.0 SAR
	jacket	bright	casual	0.0 SAR
	hoodie	bright, dark	sportswear	230.0 SAR
	cardigan	bright	casual	300.0 SR
	jeans	dark	casual	150.0 SAR

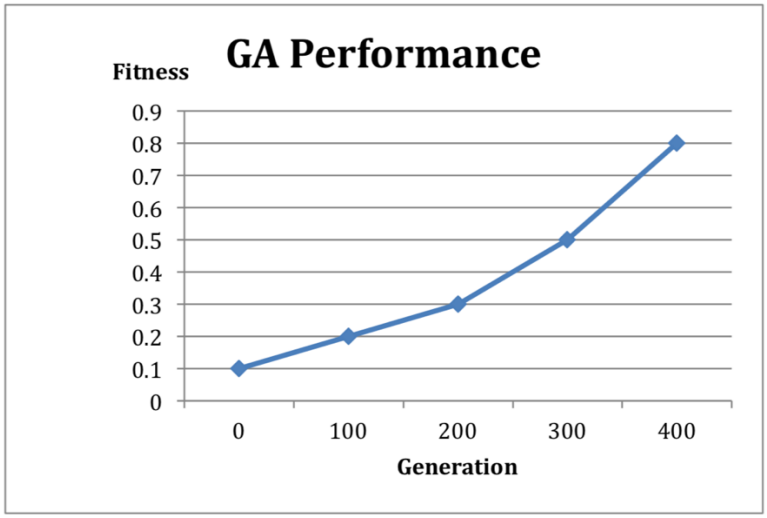
BOTTOM	knee length pant	bright	casual	220.0 SAR
	ankle length pant	dark	business	0.0 SAR
	high waist pants	bright	business	150.0 SAR
	legging	dark	casual	100.00 SAR
	sweatpants	bright	casual	100.0 SAR
	wide leg pants	dark, bright	business, evening	500.0 SAR
	maxi skirt	bright	evening	500 .0SAR
	midi skirt	dark	business	0.0 SAR
	short skirt	bright	casual	400.0 SAR
SHOES	sandals	dark	casual, evening	120.0 SAR
	sneakers	bright	sportswear, casual	300.0 SAR
	high heel	dark	evening	0.0 SAR
	mid heel	bright	casual, business	400.0 SAR
	low heel	dark	business	150.0 SAR
	flat	bright	casual	0.0 SAR
	boots	dark	casual	500.0 SAR
NECK	necklace	dark	business, evening	150.00 SAR
	choker	bright	casual, evening	0.0 SAR
	scarf	bright	casual	250.0 SAR
	tie	dark	business	100.0 SAR
	bow tie	dark	business	100.0 SAR
HANDBAG	backpack	bright	sportswear	100.0 SAR
	purse	bright	business	600.0 SAR
	clutch	dark	evening	500.0 SAR
	belt bag	dark	casual	300.0 SAR
	cross bag	dark	Business	0.0 SAR

Deliverables:

1. Python Code.
2. Report
3. Termination condition.
4. Result:

Graph of GA performance containing the generation vs fitness function as shown in the figure below for each combination of parameter setting in the table (Total of 3^3 combinations). containing explanation of your choice of:

1. Solution representation.
2. Fitness function.
3. Genetic operators:
    i. Crossover.
    ii. Mutation.
    iii. Selection by roulette wheel selection (See below).
    iv. Replacement.
4. Analysis of your results



Experimental Settings:

1. Runs: Run your GA 20 times and report the average fitness.
2. Initialize your first generation randomly in the search range.

GA Parameter	Value	Number of combinations to try
Population size	variable (multiples of 10)	3
Selection method	Roulette wheel selection	-
Crossover type	Random one point	-
Crossover rate, c	Variable 0<c<1, the higher the better	3
Mutation rate, m	Variable 0<m<1 The lower the better	3
Termination Condition	1. Try different conditions and choose the best. For example, terminate when the error value is less than 10^{-8}, or after 20000 generations. (The error value is the difference between the objective function value and the optimal solution)	-

Helpful links:

GA Explanation:

http://www.cs.ucc.ie/~dgb/courses/tai/notes/handout12.pdf
https://www.doc.ic.ac.uk/~nd/surprise_96/journal/vol1/hmw/article1.html
https://www.slideshare.net/pbpimpale/genetic-algorithms-200688

Roulette wheel Selection:

https://en.wikipedia.org/wiki/Fitness_proportionate_selection
http://www.edc.ncl.ac.uk/highlight/rhjanuary2007g02.php
https://www.youtube.com/watch?v=9JzFcGdpT8E