Q1. 2020 Exam

Part A

(a) Set

W : warehouses $w \in W$

C : customers $c \in C$

Data

- $demand_c$: demand per year of ~~xx~~ each customer c $c \in C$
- $capa_w$: widget through out capacity per year of warehouse w.
- $cost_{w,c}$: transportation cost from w to c per widget. $w \in W$

Variable: $w \in W, c \in C$

$x_{w,c}$: the amount of widgets from warehouse w to customer c

objective minimise cost.

$$\min = \sum_{\substack{w \in W \\ c \in C}} cost_{w,c} \times x_{w,c}$$

constraints

- ~~de~~ need demand.

$$demand_c \leq \sum_{w \in W} x_{w,c} \quad \forall c \in C$$

- warehouse capacity

$$capa_w \geq \sum_{c \in C} x_{w,c} \quad \forall w \in W$$

- $x_{w,c} \geq 0 \quad \forall w \in W, c \in C$

(b) Minimise cost is \$22682.

(c)

Part B

Set
W: warehouse $w \in W$
C: customers $c \in C$
Y: year $y \in Y$
L: location for rebuild $l \in L$

Data (Part A)
- $demand_{c,y}$ = customer demand per year $c \in C, y \in Y$
- $capa_{w,y}$: warehouse capacity per year. $w \in W, y \in Y$
- $tcost_{c,l}$: transport cost per widget ~~from~~ from c to l
- rcost: rebuilding cost per widget.
- $cost_{wcy}$ transport cost widget from w to c per year
- $concost_l$ = constructing facility cost $l \in L$.
- $wcapa_{l,y}$ = capacity for rebuilding widget per year at la $l \in L, y \in Y$

Variable
- $x_{w,c,y}$: the amount of widget from w to c per year.
- $Y_l = \{0,1\}$ Y_l is 1, if new facility is constructed at l $l \in L$
- Z_{cly} = the amount of rebuild widget ~~per year~~ per year from customer to c, l, to l. $c \in C, l \in L$

objective minimise cost of total building facility, widge rebuilding, and transportation

$$\text{minimize} = \sum_{\substack{w \in W \\ c \in C \\ y \in Y}} cost_{wcy} \times x_{wcy} + \cancel{\sum_{\substack{c \in C \\ l \in L}} tcost_{c,l} \times Z_{cl} + \sum}$$

$$+ \sum_{l \in L} concost_l \times Y_l + \sum_{\substack{c \in C \\ l \in L}} Z_{cl} \times (rcost + tcost_{c,l})$$

Constraints

- need demand

$$demand_{c,y} \le \sum_{w \in W} x_{w,c,y} \qquad \forall c \in C, y \in T$$

- warehouse capa

$$capa_{w,y} \ge \sum_{c \in C} x_{w,c,y} \qquad \forall w \in W, y \in T$$

- annual capa for rebuilding widget

$$y_{e} \times wcapa_{e,y} \ge \sum_{c \in C} z_{c,e,y} \qquad \forall e \in L, y \in T$$

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Part C

Question 2

Part A

stage t = dice rolls

~~Data~~

set c: color. $c \in \{red, blue\}$

Data ~~point~~

w_c = point with dice color

~~probabi~~

$P_{w,c}$ = probability ~~that~~ for getting point w with dice.

~~w= if~~

if c = red

$w = 1$ if number is odd $p = \frac{1}{2}$

$w = -1$ if number is even $p = 1/2$

if c = blue

$w = 4$ if number is 5, or 6 $p = 1/3$

$w = -2$ " below 4. $p = 2/3$.

state : S: point having at the current stage

i: color ~~of~~ we will roll at the stage.

action : select dice

Value maximise probability of winning the game.

Know $V_{50}(S, i)$: if $S > 0$, win (return 1)

if $S \leq 0$, lose (return 0)

want $V_0(0, i)$

~~$V_t(S, i) = \max_{a \in color}$~~ ~~$V_t(S$~~ • red ~~$0.5(V_{t+1}(S+1, a)) + 0.5(V_{t+1}(S-1, a))$~~

• blue ~~$\frac{1}{3} \times (V_{t+1}(S+4, a)) + \frac{2}{3}(V_{t+1}(S-2, a))$~~

$$V_t(S, i) = \max_{a \in color} \begin{cases} 0.5 \times V_{t+1}(S+1, a) + 0.5 \times V_{t+1}(S-1, a) & \text{(red)} \\ \frac{1}{3} \times V_{t+1}(S+4, a) + \frac{2}{3} V_{t+1}(S-2, a) & \text{(blue.)} \end{cases}$$

Part B

(a) submit py file:-
probwin game is if select red dice at first stage,
the probability for winning game is 0.687
otherwise, 0.688. in the case of selecting blue dice.

(b) As a result of (a), we should select blue dice at first.

(c) if m is -1 at first stage, next color change from red to blue.