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# **CS 2378 Final Project**

Simulating the gross revenue generated by a collective of entities, given the copyright term were X years.

### An explanation of the simulation

**Note:** the variable names mentioned in the brackets are the corresponding names in the variables.json document

- y= the number of years since the start of the simulation, and Y= years of simulation (simulationYears)
- ullet E= number of entities in the simulation (contentProducingEntities).
- ullet  $P_{avg}$  is the average profitability of a copyrighted work
- C= the copyright term in years (copyrightTerm)
- ullet  $R_v()\in 0,1$  is a random value generating function ( <code>Math.random</code> )

### Pure revenue generated of work = $R_w(y)$

Is modelled using a gaussian bell curve.

$$R_w(y) = floor(m_w e^{-rac{(y-p_w)^2}{2m_w^2}})$$

#### $p_w$ is the number of years for max revenue

- Let  $Y_{max}$  be the max years it takes for a work to be profitable (maxYearsTillMaxProfitability).
- It is computed as  $p_l = \{3R_v() \ ifR_v() < 0.5 \ else \ Y_{max}R_v()\}$

 $m_w$  is the revenue generated in the year of max revenue

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- Let  $d_w$  be the derivative value of the work.
  - $\circ~$  i.e. if the work is original,  $d_w=0$
  - $\circ~$  If the work was derived from an (public domain) original work,  $d_w=1$
  - $\circ~$  Else,  $d_w=d_{w2}+1$  (derivative value of the work it is derived from + 1)
- $D_f$  is the derivative factor (derivativeFactor). It models how does being a derivative work affect revenue generated from the newly generated work.
- ullet It is modelled as  $m_w=(R_v()+0.5+d_w*0.1)*0.5*P_{avg}$

#### Loss due to piracy

Is modelled as a product of already existing revenue R(y) and C with a multiplying factor  $p_l$  ( piracyMultiplier )

Loss due to piracy in any given year (y) =  $L_w(y) = \sigma((\sum_{i=1}^{y-1} R_w(i)) * C * p_l)$ 

• The sigmoid function is used to limit the range to (0,1)

#### Revenue of a work, adjusted for piracy

$$S_w(y) = R_w(i) * (1 - L_w(i))$$

### Total revenue generated by an entity = $R_e(y)$

 $R_e(y)=$  total revenue generated by an entity e till year y

### Max works possibly owned & copyrighted by an entity = $M_w(e,y)$

M(e) is the initial work production capacity.

- ullet is a constant describing the max works any entity can produce at any given point in Time ( maxWorksPerEntity ).
- I is the inequality factor  $\in \{0,1\}$  ( initialInequality ). O means a fully equal design, all entities can produce the same amount of work from the very start.

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ullet It is modelled as  $M(e)=ceil(e^{(x/S)I+1})*S$ 

Now, 
$$M_w(e,y) = R_e(y-1) * 0.01 + M(e)$$

## Probability of generating a new work in a given year = $P_g(e,y)$

- ullet W is work generating constant. Higher the value, more the content produced in a year.
- ullet P(y)= set of all publicly available content in year y
- ullet  $W_p$  is public work "inspiration" constant ( ideasFromPublicDomain ). Lower the value, more the content produced via public domain content in a year
- $\bullet$   $P_g(e,y) =$ 
  - $0 \;\; if|W(e)|>=M_w(e,y)$  (limit number of works that can be copyrighted by an entity at any given time)
  - $\circ \ 1 \ if \ R_v() < W*max(R_e(y-1),10)$
  - $\circ$  1 if  $R_v()<rac{|P(y)|}{W_n}$
  - $\circ$  0 otherwise

#### Gross revenue generated (LR)

LR =

- Initialize LR=0
- Initialize  $W_e(1) = \{\}$ . (No works in the first year)
- $for y in \{1, Y\}$ 
  - $\circ$  for e in  $\{1, E\}$ :
  - $\circ$  if  $P_g(e,y)=1$ :
  - $\circ \; W_e(y) = W_e(y-1) + W()$  (add a new copyrighted work for this entity)
  - $\circ ~ LR+=\sum_{w}^{W_e(y)}R_w(y)$
  - $\circ$  for w in  $\{1, W\}$ :
    - if  $y-C_r(w)>C$ : (if copyright term expired)
    - P(y) = P(y) + w (make public work)
    - ullet  $W_e(y)-=w$  (remove as copyrighted work)

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