ACMA 320 Actuarial Mathematics I
Computing Assignment 1
Due by 2:30 pm on Tuesday, January 28, 2020

Assume mortality follows Makeham's Law with parameters *A, B* and *c*. Use R to do the following:

- Write a function `MakehamSurv` that:
  - takes as inputs *A, B, c, x* and *t*, and
  - returns the value ${}_tp_x$.

- Write a function `tPxFiller` that:
  - takes as inputs the parameters *A, B, c, x,* ω and an increment *inc*, and
  - returns a matrix whose first column contains the values *inc*, 2**inc*, 3**inc*, … etc. and whose second column contains the corresponding probabilities of survival from age x to age x+inc, x+2*inc, … etc., all the way to ω.

  The final probability of survival should be zero, forcing the distribution to end at ω. The length of your matrix should adjust automatically to the choice of increment: it should be longer when the increment is smaller. You can use `MakehamSurv` to fill the second column of your matrix.

- Write a function `pmf` that:
  - takes as inputs the parameters *A, B, c, x,* and ω, and
  - returns a vector containing the values of ${}_{t|}q_x$ for *t=0, 1, …,* ω*-x-1*.

Set $A = 0.0005$, $B = 0.0006$, $c = 1.055$, $\omega = 120$.

1. a. Plot the survival function of (35). Use the command `plot(a, b, type='l')`, where `a` and `b` are vectors containing the x- and y-coordinates of the points to be plotted.
   b. Plot the probability mass function of (35). Use the command `plot(x, y, type='h')`.

2. Write code to calculate, for any given integer x and integer $0 \le n \le \omega - x$:
   a. The n-year temporary curtate expectation of life of x.
   b. The standard deviation of $K^*(x) = \min[K(x), n]$

3. Write code to estimate, for any given integer x and integer $0 \le n \le \omega - x$:
   a. The n-year temporary complete expectation of life of (x).
   b. The standard deviation of $T^*(x) = \min[T(x), n]$.

   Use numerical integration with an appropriate step size to achieve convergence to at least 3 decimal points.

INSTRUCTIONS:
Your code must work for any reasonable value of the input parameters.

Upload the following files to Canvas:
- Your complete R code, which Vivian will run.
- A writeup showing your plots for Question 1 and your specific results for Questions 2 and 3 with $x = 35$ and $n = 10$.