10a) $y(t) = 2t$:

$$\int_0^1 2t \; dt$$

$$= 2\left[\tfrac{1}{2} t^2 \right]_0^1$$

$$= \left[t^2 \right]_0^1$$

$$= 1$$

$\therefore$ $y(t)$ is proper since the area is 1.
If it wasn't 1, and say for example
it was 20 ($\therefore \int f(x) = 20$), then
modify it to become 1, ie $\frac{1}{20} \int f(x) = 1$.

b) Create Algorithms to generate random numbers under $y(t)$

i) Analytical Inversion Method

1) Obtain CDF

$$\int_0^x 2t \; dt$$

$$= 2\left[\tfrac{1}{2} t^2 \right]_0^x$$

$$= x^2$$

2) Obtain $(cdf)^{-1}$

$$\sqrt{x}$$

random u

3) Generate ~~u~~ from a uniform distribution.
(Assume we have a random number from a uniform dist).

(In python).

4) Then do $(cdf)^{-1}(u)$

$\sqrt{u}$

Return $\sqrt{u}$

Accept Reject Method.

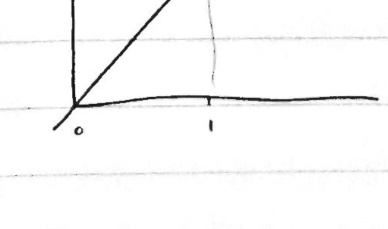
1) Assume $y(t)$ is a regular dist.

2t.

2) Define a function $h(t) = m$ where $h(t) > y(t)$
for the specified range.

$y(t)$ has maximum 2 in its range.

So we can put $h(t)$ 2.1 or 3 or 5 or...



3) a) generate u in the given range. (uniform) between 0 and 1.

b) generate v in the range [0, m].

c) if v < y(u) => accept u
else go to 'a', repeat.

d) Theoretical Comparison.

A.I.M is faster (explain why, for example ARM has 2 random generators. And it has comparisons aswell).

Include ↑ this note as 'Markdown' in notebook.

e). for 100 → number of average calculations.

Repeat for aim.

start_time

for 10,000 → number of ~~averages~~ random values

arm()

stop_time

average = $\frac{\text{stop - start}}{10{,}000}$

aim_avg_list . append.

list 1

list 2.

One way Anova

- Give it list 1 and list 2.

list 1 -> list_to_ARM = [...] 100 elements

" ARM.

- gives you a pval

you define it. Set it to 0.05.

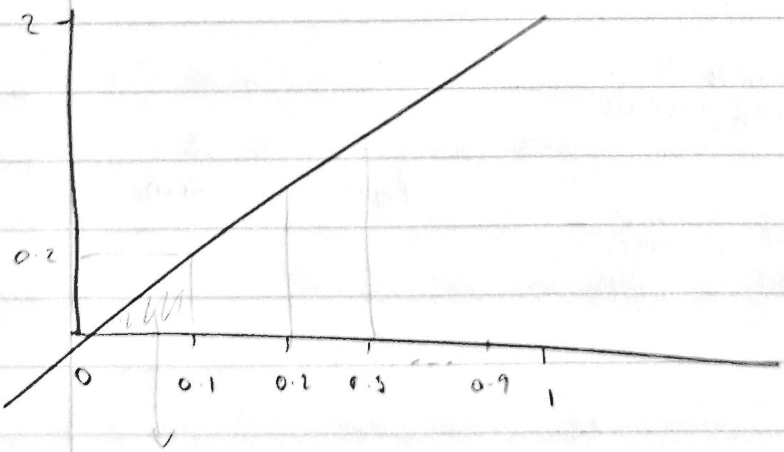
- if p_val <= Sig_val

- Statistical significantly different.

else

not statistically significantly different.

Chi Squared



We generate

1,000 random numbers

This area

$\frac{1}{2} b \times h = 0.01$

We should get 0.01×1000

Expected freq.

Continue for all 0.2, 0.3, ...

Then we need the observed.

Generate 1000 from each AIM and ARM.

Calculate the frequencies (observed).

Divide them into bins.

$$\chi^2 = \frac{\sum (\text{freq\_exp} - \text{freq\_obs})^2}{\text{freq\_exp}}$$

'Some useful tips' in vle shows chi squared.

N.B. Degrees of freedom is the number of bins minus 1.

So $10 - 1 = 9$.