

RECOMP II USERS' PROGRAM NO. 1092

PROGRAM TITLE: AGC-157 PROBABILITY

PROGRAM CLASSIFICATION: General Topics

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PURPOSE: To determine the probability of M successes
out of N trials in a learning sequence.

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TITLE: AGC-157 PROBABILITY (FLOATING POINT)

LOCATIONS USED: 3000 - 6076

PURPOSE: To determine both the probability of exactly M successes out of N trials and the probability of at least M successes out of N trials in a learning sequence. The probability of no successes (P_0), the mean (μ), and the variance (σ^2) are also calculated. Three separate equations for learning curves may be used or the learning curve omitted entirely by entering the probabilities of failure (q) for each trial.

RESTRICTIONS: This program is used in conjunction with Program Preparation Package Number Two. The constant data is stored in locations 3500 through 3560 and is on the program tape. If the program is manually started at location 3000, the number of trials (N) and the probabilities of failure (q) for each trial are called for and input on typewriter.

If start 1, 2, or 3 are used, the number of trials (N) and the constants (a & b) for the learning curve are called for and input on the typewriter.

The maximum number of trials is 128.

METHOD:

$$P_m = P_0 \sum_{i=1}^N \left\{ R_i \sum_{j=i+1}^N \left\{ R_j \sum_{k=j+1}^N [R_k \sum (\dots)] \right\} \right\}$$

$$\text{where } P_0 = \prod_{r=1}^N q_r$$

$$\text{Case 2 } q_r = b e^{-a(r-1)}$$

$$\text{Case 3 } q_r = a + b r$$

$$\text{Case 4 } q_r = \frac{1}{a + b r}$$

Learning curves where r goes from 1 to N .

$$P_x = 1 - q_x$$

$$R_x = \frac{P_x}{q_x}$$

$$\mu = \sum_{x=1}^N P_x$$

$$\sigma^2 = \sum_{x=1}^N (P_x^2) - N \left(\frac{\mu}{N} \right)^2$$

USAGE:

Set margins at 10 and 90. Set tabs at 30, 60, and 80.

Set tab switch on tab.

MANUAL START, L3000.0

The learning curve is omitted.

1. Start in L3000.0
2. Enter number of trials (N)
3. Enter probabilities of failure for each trial (q_1, q_2, \dots, q_n) and end with a negative number (-1). q is always less than 1.0.

START 1

The learning curve is $q_y = be^{-a(y-1)}$

1. Press Start 1
2. Enter number of trials (N) and learning curve constants (a & b)

START 2

The learning curve is $q_y = a + b^y$

1. Press start 2
2. Enter number of trials (N) and learning curve constants (a & b)

START 3

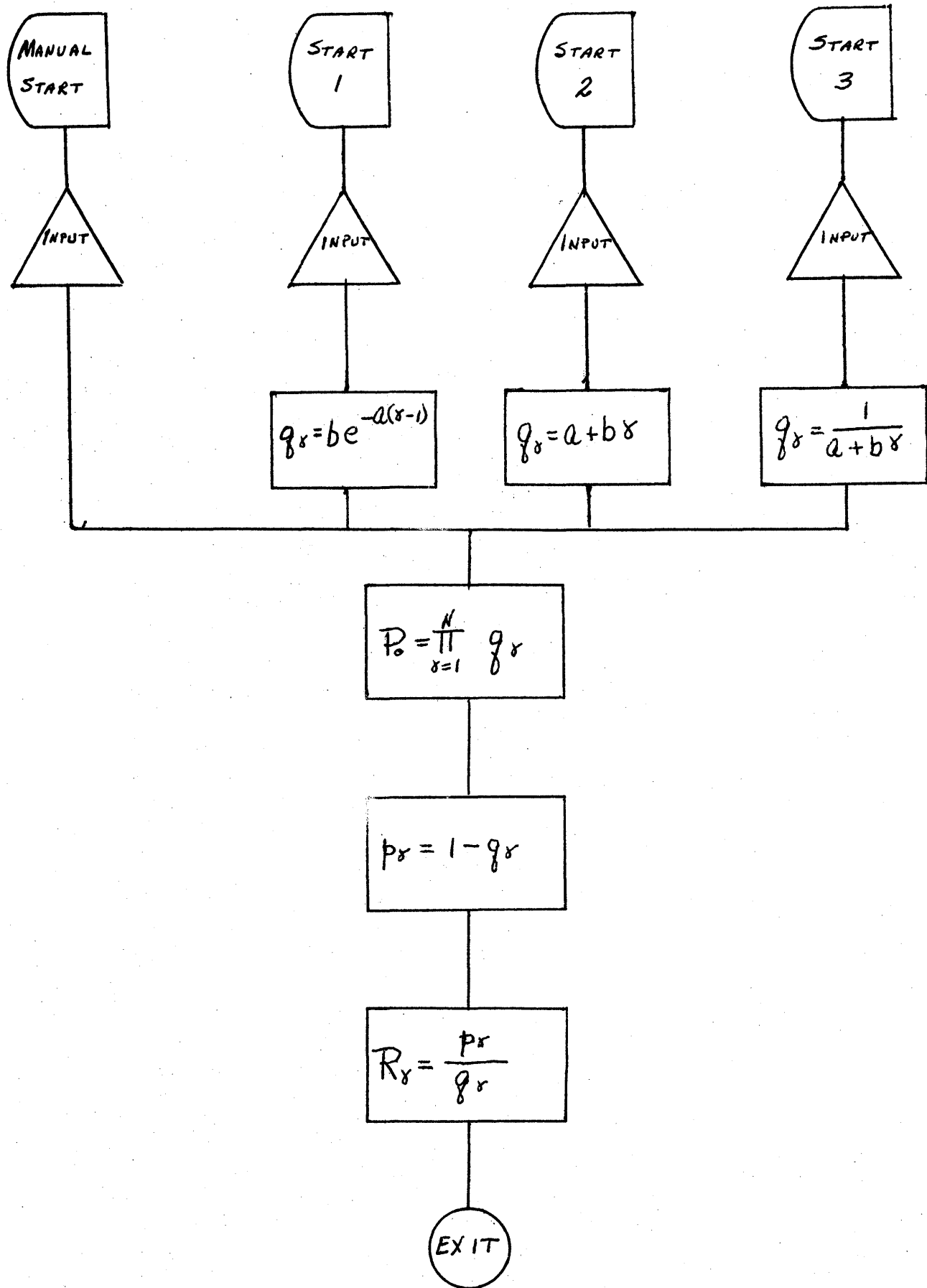
The learning curve is $q_Y = \frac{1}{a + b Y}$

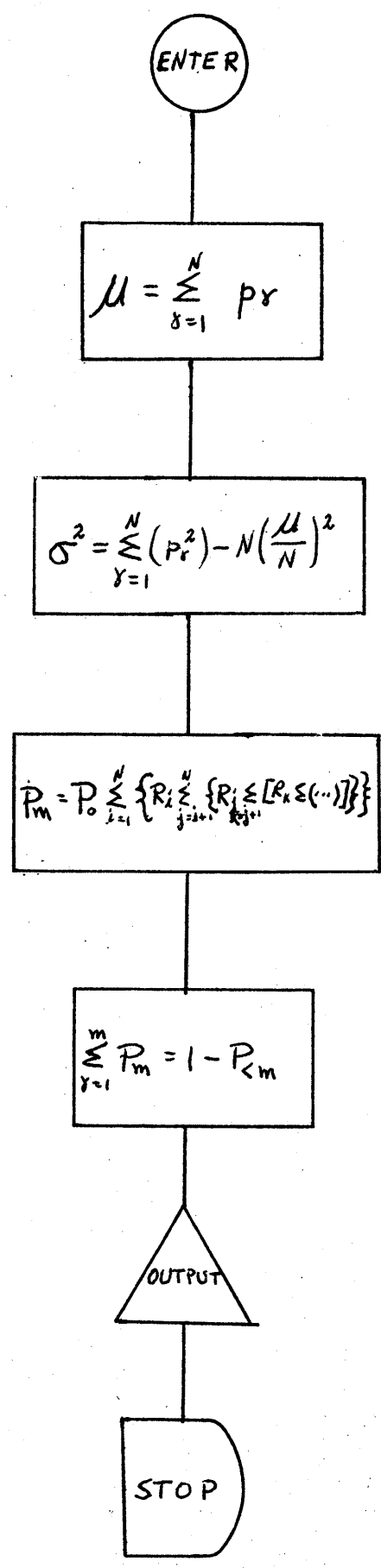
1. Press start 3
2. Enter number of trials (N) and learning curve constants (a & b)

TIME:

For number of trials (N) = 5 -- approximately 2 minutes

For number of trials (N) = 100 -- approximately 1 hour





PROBABILITY OF M SUCCESSES OUT OF N TRIALS
IN A LEARNING SEQUENCE

N
5

P
 .0
 .1
 .2
 .3
 .4
 .5
 .6
 .7
 .8
 .9
 1.0

PO
 .031250000000

MEAN
 2.50000

VARIANCE
 1.25000000000

M
 .0
 1.0
 2.0
 3.0
 4.0
 5.0

EXACTLY M SUCC
 .031250000000
 .156250000000
 .312500000000
 .312500000000
 .156250000000
 .031250000000

AT LEAST M SUCC
 1.000000000000
 .968750000000
 .812500000000
 .500000000000
 .187500000000
 .031250000000

1.000000000000

PROBABILITY OF M SUCCESSES OUT OF N TRIALS
IN A LEARNING SEQUENCE

A
.01745

B
.2

N
5

PO
.00026876059335

MEAN
4.03400

VARIANCE
.77925274533

M
.0
1.0
2.0
3.0
4.0
5.0

EXACTLY M SUCC
.00026876059335
.0056159642234
.046929023521
.196032077452
.409337180343
.341816993874

AT LEAST M SUCC
1.0000000000
.99973123941
.99411527519
.94718625167
.75115417422
.341816993874

1.00000000000

PROBABILITY OF M SUCCESSES OUT OF N TRIALS
IN A LEARNING SEQUENCE

A
.1

B
.1

N
5

PO
.007200000000

MEAN
3.00000

VARIANCE
1.09999999998

M
.0
1.0
2.0
3.0
4.0
5.0

EXACTLY M SUCC
.007200000000
.068400000000
.234400000001
.364400000006
.258400000006
.067200000002

AT LEAST M SUCC
1.00000000000
.992800000000
.924400000000
.690000000000
.325599999993
.067199999987

1.000000000001

PROBABILITY OF M SUCCESSES OUT OF N TRIALS
IN A LEARNING SEQUENCE

A
1

B
2

N
5

PO

.00009620009620

MEAN

4.12179

VARIANCE

.68608126202

M

.0
1.0
2.0
3.0
4.0
5.0

EXACTLY M SUCC

.00009620009620
.00288600288603
.032708032709
.173160173164
.421741221751
.369408369417

AT LEAST M SUCC

1.000000000000
.99990379991
.99701779702
.96430976432
.79114959115
.369408369403

1.000000000002

L00010	C+5760220+4000000	+5760270+4000000	+5760430+4000000	
L30000	C+5760000+5716450	+0030030+0030160	+5730170+4000000	+1026120-3031030
L30040	C+3106220-0620250	+0430150-0434040	+0507160-1601050	+0501050-0430070
L30100	C+2004300-1504140	+0420120-0603220	+0510060-1404030	+0422010-0312140
L30140	C+0614320-0405010	+2707010-1416010	+1010100-0000000	+5700000+5716450
L30200	C+0030220+0030230	+5730240+4000000	+3703330-1037310	+3310370-1410330
L30240	C+5722140+3537040	+5722140+3535000	+5722140+3535060	+3035140+0535360
L30300	C+0435060+3535160	+3535420+4000000	+5700000+4000000	+3537000+3035020
L30340	C+0535000+5727001	+3537020+3437020	+0537000+3537040	+3035120+0635100
L30400	C+0737040+3537060	+3437060+5727201	+0735000+3550000	+4000000+4000000
L30440	C+4000000+0030420	+0132400+6030420	+3035120+0435140	+3535120+0635160
L30500	C+5130370+3035200	+3535120+4000000	+4000000+0032430	+6030420+3035220
L30540	C+0750000+3535220	+0030540+0132410	+6030540+3035100	+0650000+3554000
L30600	C+0030570+0132420	+6030570+3035240	+0454000+3535240	+0030620+0132410
L30640	C+6030620+4000000	+3054000+0754000	+0435260+3535260	+3054000+0550000
L30700	C+3540000+0030650	+0132420+6030650	+0030670+0132420	+6030670+0030700
L30740	C+0132410+6030700	+3035120+0435140	+3535120+0635160	+5130531+3035100
L31000	C+0535060+0735240	+3537100+0737100	+0735060+3537120	+3035260+0637120
L31040	C+5733130+0032440	+6030540+0032450	+6030570+0032460	+6030620+0032470
L31100	C+6030650+0032500	+6030670+0030700	+4232510+0032520	+6030700+5760610
L31140	C+0031160+0031210	+5731220+4000000	+3710100-2630330	+1037340-0733100
L31200	C+3705060-3234030	+0405270-1000000	+3035220+5722531	+4000000+4000000
L31240	C+7200100+4000000	+3035240+5701500	+0003050+7731250	+7200100+4000000
L31300	C+3037140+5722531	+4000000+4000000	+7200370+7200100	+7200330+0032510
L31340	C+0332410+4231400	+5732770+0132530	+4231371+4231401	+3035300+3544000
L31400	C+0440000+3544000	+3535300+0031400	+0332540+5031500	+0031370+0332400
L31440	C+6031370+0031400	+0332410+6031400	+0031400+0332400	+6031400+5731370
L31500	C+0032510+0332410	+4232550+0032550	+0132560+4231610	+4231620+4232570
L31540	C+0032550+0333100	+4231600+4000000	+0032600+0132410	+4232600+4232610
L31600	C+3040000+4000000	+0744100+0435320	+3544100+3535320	+0031620+0332610
L31640	C+5031711+0031600	+0332410+6031600	+0031610+0332410	+6031610+0031620
L31700	C+0332410+6031620	+5731600+3035340	+3535320+3035360	+0435400+3535360
L31740	C+0635420+5232000	+0032620+0132630	+6032620+3632620	+4000000+5733060

L32000	C+7200370+5733430	+0032030+0032040	+5732050+4000000	+1010340-3310370
L32040	C+2610330-0000000	+3035440+5701500	+0003010+7732050	+7200100+5733170
L32100	C+3044000+0735220	+3537160+5733030	+3035460+0437160	+3535460+3035440
L32140	C+0435400+3535440	+0635420+5132640	+5760700+3535440	+3035520+3535360
L32200	C+3035340+3535300	+0032700+6032600	+0032630+6032620	+3035340+3535240
L32240	C+3535260+3535460	+3035100+3535220	+5732710+4000000	+7200370+5716450
L32300	C+0032320+0032330	+5732340+4000000	+1533270-1037140	+3310370-0310330
L32340	C+5722140+3535000	+5722140+3535060	+5722140+3537040	+5730370+4000000
L32400	C+0000000-0000020	+0000020-0000000	+0000020-0000020	+0735000+3550000
L32440	C+0750000+3535220	+0650000+3554000	+0454000+3535240	+3054000+0754000
L32500	C+3054000+0550000	+0040120+0000000	+3540000+0030650	+0000000-0004000
L32540	C+0440000+3544000	+0040100+0000000	+0004000-0000000	+0044100+0000000
L32600	C+0044000+0000000	+3544100+3535320	+0000000-0000010	+0000000-0000010
L32640	C+0032670+0132410	+4232100+4000000	+5732750+4000000	+0044000+0044000
L32700	C+0044000+0000000	+3035200+3535120	+0032760+4232100	+4000000+6032670
L32740	C+5733110+4000000	+6032670+5733010	+0044000+0044000	+0031400+4000240
L33000	C+5731351+4000000	+7200370+7200100	+7200330+5732050	+3037160+5722531
L33040	C+4000000+4000000	+5733310+4000000	+0033100+0132410	+4233100+5731500
L33100	C+0000020-0000000	+0032410+6033100	+7730000+4000000	+3537140+3035100
L33140	C+0637100+0737100	+0735060+0637140	+3537140+5731041	+3035560+0435100
L33200	C+3535560+0635600	+5233270+3035220	+5722531+7200100	+3035540+5722531
L33240	C+7200370+7200100	+7200330+3035220	+3537160+5733400	+3035540+0637160
L33300	C+3535540+5732100	+7200100+3035540	+5722531+5732120	+7200370+7200100
L33340	C+3035460+0435220	+5722531+3035100	+3535560+3535540	+5733420+4000000
L33400	C+3035100+3535440	+5732050+4000000	+3035500+5732161	+4000000+5716450
L33440	C+0033460+0033540	+5732050+4000000	+1010040-0404340	+3310370-0135030
L33500	C+1620220-2504340	+0405070-1616330	+1037030-2004220	+0103050-2004340
L33540	C+0405070-1616100			
L60000	C+0060020+4230170	+7200370+5730001	+5760030+4000000	+7200140+7200100
L60040	C+7200330+5722140	+3535060+3035140	+0535360+0435060	+3535160+3535420
L60100	C+7200370+7200100	+7200270+7200100	+7200330+5722140	+3550000+5160170
L60140	C+0060130+0160160	+4260130+5760121	+0000020-0000000	+0060210+4260130
L60200	C+5730531+4000000	+3550000+5160160	+0060250+4230170	+0060260+4230320

L60240	C+7200370+5730001	+5730171+4000000	+5730370+4000000	+0060320+4230170
L60300	C+0060330+4230320	+7200370+5730001	+5730171+4000000	+5760340+4000000
L60340	C+3035120+0735000	+0437040+3550000	+0060350+0132400	+4260351+3035120
L60400	C+0435140+3535120	+0635160+5160340	+5760720+4000000	+0060460+4230170
L60440	C+0060470+4230320	+7200370+5730001	+5730171+4000000	+5760500+4000000
L60500	C+3035120+0735000	+0437040+3537000	+3035100+0537000	+4000000+3550000
L60540	C+0060530+0132400	+4260531+3035120	+0435140+3535120	+0635160+5160500
L60600	C+5760750+4000000	+7200370+5716450	+0060640+0060670	+5731220+4000000
L60640	C+1010260-3033100	+3700340-0103140	+3310370-3603120	+0603140-1601100
L60700	C+7200370+7200100	+7200100+5733330	+0060740+4260351	+5730501+4000000
L60740	C+0437040+3550000	+0060740+4260531	+5730501+4000000	
L35000	C+4000000-0000000	-0000000-0000000	+0177770+7200000	+6077760+5277741
L35040	C+5777610+5700000	+1577600+6416200	+5000000-0000000	+0000000-0000011
L35100	C+4000000-0000000	+0000000-0000001	+4000000-0000000	+0000000-0000001
L35140	C+4000000-0000000	+0000000-0000001	+5400000-0000000	+0000000-0000011
L35200	C+4000000-0000000	+0000000-0000001	+4000000-0000000	+0000000-0000001
L35240	C+0000000-0000000	+0000000-0000231	+0000000-0000000	+0000000-0000231
L35300	C+0000000-0000000	+0000000-0000231	+0000000-0000000	+0000000-0000231
L35340	C+0000000-0000000	+0000000-0000231	+4000000-0000000	+0000000-0000010
L35400	C+4000000-0000000	+0000000-0000001	+5400000-0000000	+0000000-0000011
L35440	C+0000000-0000000	+0000000-0000231	+0000000-0000000	+0000000-0000231
L35500	C+0000000-0000000	+0000000-0000231	+4000000-0000000	+0000000-0000010
L35540	C+4000000-0000000	+0000000-0000001	+4000000-0000000	+0000000-0000001
L35600	C+5000000-0000000	+0000000-0000010		