

Gestational Age Calculation *

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The importance of determining gestational age as accurately as possible to structure perinatal care (including decisions about timing and route of delivery or terminology issues like allocating diagnosis of abortion versus Intra Uterine Fetal Death) has no debate.

It is noteworthy to name some ways of determining gestational age based on Last Menstrual Period (LMP).

1- **Nägele's Rule:** This was developed in the 1850's by Dr. Nägele, who determined that the average human pregnancy was 266 days from conception, or 280 days (40 weeks) from the first day of the of the last menstrual period. To calculate this, one should add 7 days, and then subtract 3 months from LMP.

$(\text{LMP} + 7 \text{ days}) - 3 \text{ months} = \text{Expected Date of Delivery}$

Example: ((the LMP on 1st April + 7 days) - 3 months) = January 8

This "rule" doesn't take into account the fact that many women are uncertain of the date of their last menstrual period, not all women have 28 day cycles, and not all women ovulate on day 14 of their cycle.(4)

2- **Mittendorf Rule:** In an article in 1990, Mittendorf showed that an average pregnancy is 269 days for mothers who've given birth before. Non-Caucasian women have shorter pregnancies than Caucasian; for example, African-American women average 266 days.

To calculate "Mittendorf's Rule", one should add 15 days for first time Caucasian women, or add 10 days if non-white or this is not the first baby. Then subtract 3 months. (3)

$(\text{LMP} + 15 \text{ days}) - 3 \text{ months} = \text{Expected Date of Delivery for first time pregnant Caucasian women}$

Example: ((LMP on 1st April + 15 days) - 3 months) = January 16

The Nagele rule is based on 280 day-from-LMP gestational age while Mittendorf believe multiparas and non-white women deliver 5 days in advance.

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To be released as a Persian and English software for clinical use

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3- **Miscellaneous:** There have been pregnancy wheels (1) and gestational age calendars (2) and calculation softwares like Microsoft Excel program which are related to English months, thus not of use to Persian audience (which are made up of vast arrays of population ranging from Persian to Arabic pregnant women) who use different terms in their calendars. The available date calculation programs give the age between two dates in months or days.

4- **Calculations by fingers!:** As days of a year are composed of a heterogeneous combinations of numbers (like six months of 31 days, one month of 29 days which is 30 days every 4 years) , introducing a simple, straight forward formula is practically impossible. The Obstetrics rule that gestational age should be presented in weeks +days adds to the complexity. The only resort is to go through the lengthy procedure of our ancestors to use fingers or add /divide mathematics.

The following algorithm is what we go through unconsciously when we calculate the gestational age; from LMP to the time of visit.

1- First we have two dates:

LMP: like 85/12/3(which is 2007/Feb/22), and the date the woman comes to clinic like 86/ 4/2. We consider the beginning and the end months, with three months in between. The **difference of days** is calculated based on table 1.

If the number falls in the highlighted zone (yellow numbers), one month is added to the LMP; in this example 85/12/3 would change to 85/1/3. The difference of the days is 29 days. If the number falls in the non-highlighted zones, the month of LMP wouldn't be changed.

2- **The difference of months between LMP and visit** is calculated according to table 2.

According to the LMP of 85/12/3 (here it changed to 86/1/3) and visit on 86/4/2, the table shows there are 3 months (12 weeks) / plus 3 months of 31 days in between.

3- Now we have 32 days (29+3) and 12 weeks. Going to the column of three (12 weeks), we reach the number 32. Then we read the number on the red-lighted column that is 5w+3d.

4- So the final number of gestational age would be 17w+3d.

5- If the month of 12 is 29 days, the gestational age is 17w+2 d, and if it is 30 days, GA is 17w+3d.

It should also be stated that for the sake of convenience, table 2 can be used alone if the first calculation is done by rote.

If a traditional calculation of one GA takes about 5 minutes, using the table (after mastery of working with it) will take 2 minutes.

If this has to be done 50 times a shift, in a crowded clinic like Shariaty Hospital in Bandar Abbas a district near Persian Gulf, then 2 and a half hour is left for concentration on more important issues if not to talk about error of measurement so common in finger calculation.

References:

- 1- Cunningham G, Gant N, Leveno K, et al. (2005) Williams Obstetrics. 22nd Ed New York: Mc Graw Hill.
- 2- Military Obstetrics and Gynecology. Brookside Press. (2006) Estimating Gestational age. See: www.brooksidepress.org/.../Pregnancy/estimating_gestational_age.htm
- 3- Mittendorf R, Williams M, Berkey C, Cotter P. (1990). The Length of Uncomplicated Human Gestation. *Obstetrics & Gynaecology* 75(6):929-932
- 4- Transition to Parenthood. Durham J. (2004) How accurate is your due date see: www.transitiontoparenthood.com/ttp/parented/pregnancy/duedate.htm and www.pregnancy.about.com/library/weekly/aa042197.htm

Table1- The vertical column is for LMP and the horizontal column is for the day of visit.

	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
1	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
2	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	29
3	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	29	28
4	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	29	28	27
5	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	29	28	27	26
6	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	29	28	27	26	25
7	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	29	28	27	26	25	24
8	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	29	28	27	26	25	24	23
9	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	29	28	27	26	25	24	23	22
10	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	29	28	27	26	25	24	23	22	21
11	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	29	28	27	26	25	24	23	22	21	20
12	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	29	28	27	26	25	24	23	22	21	20	19
13	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	29	28	27	26	25	24	23	22	21	20	19	18
14	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	29	28	27	26	25	24	23	22	21	20	19	18	17
15	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	29	28	27	26	25	24	23	22	21	20	19	18	17	16
16	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15
17	13	12	11	10	9	8	7	6	5	4	3	2	1	0	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14
18	12	11	10	9	8	7	6	5	4	3	2	1	0	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13
19	11	10	9	8	7	6	5	4	3	2	1	0	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12
20	10	9	8	7	6	5	4	3	2	1	0	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11
21	9	8	7	6	5	4	3	2	1	0	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10
22	8	7	6	5	4	3	2	1	0	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9
23	7	6	5	4	3	2	1	0	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8
24	6	5	4	3	2	1	0	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7
25	5	4	3	2	1	0	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6
26	4	3	2	1	0	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5
27	3	2	1	0	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4
28	2	1	0	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3
29	1	0	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2
30	0	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1

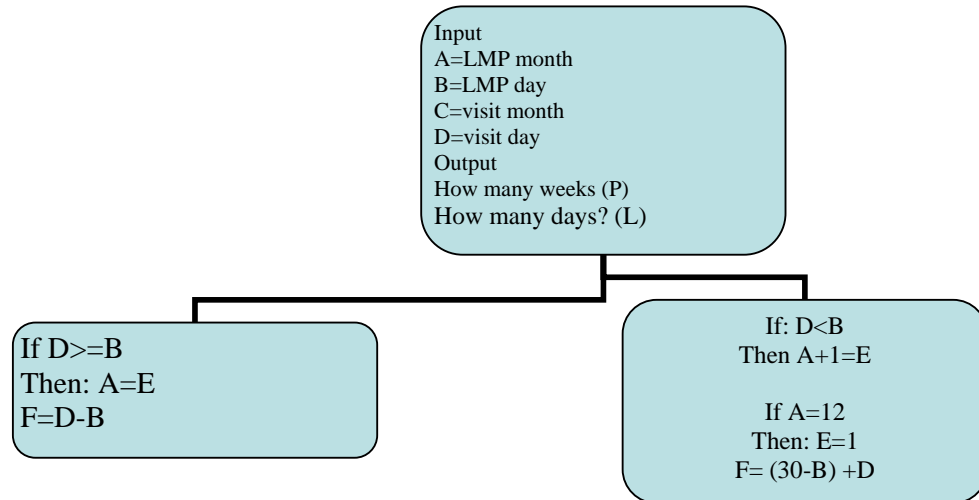
Table2-LMP month (high lighted) and Visit month/ number of 31- day months between LMP and Visit

LMP	Visit/ no of 31-day months between LMP and Visit								
1	8/7	5/4	2/1	9/6	6/5	3/2	10/6	7/6	4/3
2	9/6	6/4	3/1	10/5	7/5	4/2	11/5	8/5	5/3
3	10/5	7/4	4/1	11/4	8/4	5/2	12/4	9/4	6/3
4	11/4	8/3	5/1	12/3	9/3	6/2	1/3	10/3	7/3
5	12/3	9/2	6/1	1/2	10/2	7/2	2/3	11/2	8/2
6	1/1	10/1	7/1	2/2	11/1	8/1	3/3	12/1	9/1
7	2/1	11	8	3/2	12	9	4/3	1	10
8	3/2	12	9	4/3	1	10	5/4	2/1	11
9	4/3	1	10	5/4	2/1	11	6/5	3/2	12
10	5/4	2/1	11	6/5	3/2	12	7/6	4/3	1
11	6/5	3/2	12	7/6	4/3	1	8/6	5/4	2/1
12	7/6	4/3	1	8/6	5/4	2/1	9/6	6/5	3/2
****	7(30W)	4(17w)	1(4w)	8(34W)	5(21W)	2(8W)	9(38)	6(25W)	3(12W)
5w+4	39	38	37	37	36	35	35	34	33
5w+3	38	37	36	36	35	34	34	33	32
5w+2	37	36	35	35	34	33	33	32	31
5w+1	36	35	34	34	33	32	32	31	30
5w	35	34	33	33	32	31	31	30	29
4w+6	34	33	32	32	31	30	30	29	28
4w+5	33	32	31	31	30	29	29	28	27
4w+4	32	31	30	30	29	28	28	27	26
4w+3	31	30	29	29	28	27	27	26	25
4w+2	30	29	28	28	27	26	26	25	24
4w+1	29	28	27	27	26	25	25	24	23
4w	28	27	26	26	25	24	24	23	22
3w+6	27	26	25	25	24	23	23	22	21
3w+5	26	25	24	24	23	22	22	21	20
3w+4	25	24	23	23	22	21	21	20	19
3w+3	24	23	22	22	21	20	20	19	18
3w+2	23	22	21	21	20	19	19	18	17
3w+1	22	21	20	20	19	18	18	17	16
3w	21	20	19	19	18	17	17	16	15
2w+6	20	19	18	18	17	16	16	15	14
2w+5	19	18	17	17	16	15	15	14	13
2w+4	18	17	16	16	15	14	14	13	12
2w+3	17	16	15	15	14	13	13	12	11
2w+2	16	15	14	14	13	12	12	11	10
2w+1	15	14	13	13	12	11	11	10	9
2w	14	13	12	12	11	10	10	9	8
1w+6d	13	12	11	11	10	9	9	8	7
1w+5d	12	11	10	10	9	8	8	7	6
1w+4d	11	10	9	9	8	7	7	6	5
1w+3d	10	9	8	8	7	6	6	5	4
1w+2d	9	8	7	7	6	5	5	4	3
1w+1d	8	7	6	6	5	4	4	3	2
1W	7	6	5	5	4	3	3	2	1
6	6	5	4	4	3	2	2	1	3(12w)
5	5	4	3	3	2	1	1	6(25w)	
4	4	3	2	2	1	2(8w)	9(38w)		
3	3	2	1	1	5(21w)				
2	2	1	1(4w)	8(34w)					
1	1	4(17w)							

Table3- list of variables**E=LMP month (vertical column)****N=number of weeks****G=number of days added****H= number of 31- day months between LMP and Visit**

	N=30 G=0	N=17 G=1	N=4 G=2	N=34 G=2	N=21 G=3	N=8 G=4	N=38 G=4	N=25 G=5	N=12 G=6
E=1	C=8 H=7	C=5 H=4	C=2 H=1	C=9 H=6	C=6 H=5	C=3 H=2	C=10 H=6	C=7 H=6	C=4 H=3
E=2	C=9 H=6	C=6 H=4	C=3 H=1	C=10 H=5	C=7 H=5	C=4 H=2	C=11 H=5	C=8 H=5	C=5 H=3
E=3	C=10 H=5	C=7 H=4	C=4 H=1	C=11 H=4	C=8 H=4	C=5 H=2	C=12 H=4	C=9 H=5	C=6 H=3
E=4	C=11 H=4	C=8 H=3	C=5 H=1	C=12 H=3	C=9 H=3	C=6 H=2	C=1 H=3	C=10 H=3	C=7 H=3
E=5	C=12 H=3	C=9 H=2	C=6 H=1	C=1 H=2	C=10 H=2	C=7 H=2	C=2 H=3	C=11 H=2	C=8 H=2
E=6	C=1 H=1	C=10 H=1	C=7 H=1	C=2 H=2	C=11 H=1	C=8 H=1	C=3 H=2	C=12 H=1	C=9 H=1
E=7	C=2 H=1	C=11	C=8	C=3 H=2	C=12	C=9	C=4 H=3	C=1	C=10
E=8	C=3 H=2	C=12	C=9	C=4 H=3	C=1	C=10	C=5 H=4	C=2 H=1	C=11
E=9	C=4 H=3	C=1	C=10	C=5 H=4	C=2 H=1	C=11	C=6 H=5	C=3 H=2	C=12
E=10	C=5 H=4	C=2 H=1	C=11	C=6 H=5	C=3 H=2	C=12	C=7 H=6	C=4 H=3	C=1
E=11	C=6 H=5	C=3 H=2	C=12	C=7 H=6	C=4 H=3	C=1	C=8 H=6	C=5 H=4	C=2 H=1
E=12	C=7 H=6	C=4 H=3	C=1	C=8 H=6	C=5 H=4	C=2 H=1	C=9 H=6	C=6 H=5	C=3 H=2

Algorithm one: The process of gestational age calculation



K, F, G, H, L, M, N mean:

$$K = F + G + H$$

$$K/7 = M + \text{remainder of } K/7$$

$$L = \text{remainder of } K/7$$

$$P = M + N$$