UNIVERSITI SAINS MALAYSIA

Peperiksaan Semester Kedua
Sidang Akademik 2006/2007
Second Semester Examination
Academic Session 2006/2007

April 2007

EBS 339/3 - Ekonomi Mineral
EBS 339/3 - Mineral Economics

Masa : 3 jam
Time : 3 hours

Sila pastikan bahawa kertas peperiksaan ini mengandungi TIGA BELAS muka surat beserta TIGA muka surat (Lampiran) yang bercetak sebelum anda memulakan peperiksaan.

Kertas soalan ini mengandungi TUJUH soalan. EMPAT soalan di BAHAGIAN A dan TIGA soalan di BAHAGIAN B. Terjemahan dalam Bahasa Inggeris ada disertakan.

Jawab LIMA soalan. Jawab DUA soalan dari BAHAGIAN A, DUA soalan dari BAHAGIAN B dan satu soalan dari mana-mana bahagian. Jika calon menjawab lebih daripada lima soalan hanya lima soalan pertama mengikut susunan dalam skrip jawapan akan diberi markah.

Mulakan jawapan anda untuk setiap soalan pada muka surat yang baru.

Semua soalan boleh dijawab samada dalam Bahasa Malaysia atau Bahasa Inggeris.

Please check that this examination paper consists of THIRTEEN pages of printed material and THREE pages APPENDIX before you begin the examination.

This paper contains SEVEN questions. FOUR questions in PART A and THREE questions in PART B. Translations in English are enclosed together with this script.

Answer any FIVE questions. Answer TWO questions from PART A, TWO questions from PART B and ONE question from any sections. If a candidate' answers more than five questions, only the first five answers will be examined and awarded marks.

Answer to any question must start on a new page.

All questions could be answered in Bahasa Malaysia or English.

...2/-

BAHAGIAN A

1. Unjuran aliran tunai untuk suatu projek perlombongan adalah seperti berikut:

Tahun	Perbelanjaan Modal (RM 000)	Pendapatan Kasar (RM 000)	Kos Operasi (RM 000)
-2	1,000		
-1	3,000		
0	6,000		
1		7,000	4,000
2		7,500	4,300
3		8,000	4,600
4		8,500	4,900
5		9,000	5,200

30% daripada perbelanjaan modal adalah untuk pembelian tanah perlombongan dan bakinya digunakan untuk pembangunan lombong sehingga ke peringkat pengeluaran.

Andainya:-

(i) Susut nilai dilaksanakan pada kadar 20% pada tiap-tiap tahun ke atas baki modal berkenaan.

(ii) Pemupusan sepenuhnya dilaksanakan sama rata sepanjang hayat lombong.

(iii) Royalti dibayar pada kadar 2% ke atas pendapatan kasar.

(iv) Cukai pendapatan dibayar pada kadar 40%.

(v) Kos modal adalah 10%.

Kirakan:

[a] Jumlah aliran tunai bersih untuk projek

(7 markah)

[b] Nilai kini aliran tunai bersih pada kos modal

(6 markah)

[c] Kadar pulangan dalaman aliran tunai terdiskaun untuk projek

(3 markah)

[d] Tempoh bayar balik projek

(2 markah)

[e] Beri ulasan anda tentang projek ini

(2 markah)

...3/-

2. [a] Terangkan apakah yang dimaksudkan dengan penilaian projek dan nyatakan jenis-jenis penilaian projek?

(5 markah)

[b] Bincangkan tiga (3) jenis penilaian projek. Berikan kelebihan dan kekurangan jenis penilaian projek yang dibincangkan.

(7 markah)

[c] Bincangkan perkara-perkara yang perlu dipertimbangkan dalam menilai sesuatu projek.

(4 markah)

[d] Terang dan bincangkan teknik-teknik penentuan kos modal.

(4 markah)

3. Sebuah syarikat perlombongan, COMMREC Sdn.Bhd. bercadang untuk meningkatkan pegeluaran tahunannya memandangkan keadaan ekonomi yang baik. Untuk itu, syarikat perlu membesarkan kemampuan bahagian perlombongan dan loji pemprosesan. Dua kajian aliran tunai telah dikemukakan untuk pertimbangan:

Projek	Pelaburan Modal Diperlukan (RM)	Aliran Tunai Masuk Tahuan (RM)	Hayat Projek
X	5,000,000	1,000,000	9
Y	6,500,000	1,250,000	9

Sekiranya kos modal adalah 12%

[a] Kirakan kadar pulangan dalaman aliran tunai terdiskaun untuk projek X dan Y.

(12 markah)

[b] Perakukan projek yang patut diterima dan berikan alasan-alasan untuk meyokong perakuan tersebut.

(8 markah)

...4/-

4. [a] Terangkan tentang kos operasi dan teknik-teknik untuk menganggar kos operasi tersebut.

(5 markah)

[b] Bincangkan dua (2) kaedah persampelan yang sering dilakukan semasa explorasi.

(5 markah)

[c] Terangkan sebab yang menjadikan sampel yang diambil tidak tepat bagaimana anda dapat menghindar ianya dari berlaku.

(5 markah)

[d] Dalam analisis kepekaan, aliran tunai sesuatu projek perlombongan boleh berubah apabila faktor-faktor yang berkaitan dengannya berubah. Nyatakan faktor-faktor tersebut dan bincangkan faktor yang paling sensitif.

(5 markah)

BAHAGIAN B

5. [a] Bincangkan faktor-faktor yang mempengaruhi **proses pembekalan mineral** dalam fasa perancangan perkembangan projek perlombongan.

(5 markah)

[b] Terangkan kandungan yang perlu dibincangkan dalam **laporan kajian kebolehlaksanaan** untuk membantu dalam penentuan kebolehjayaan sesuatu projek pengeluaran mineral yang dicadangkan.

(10 markah)

[c] Kirakan **kadar perlombongan** tahunan dalam hektar/tahun untuk kawasan bijih emas berpotensi yang mempunyai kandungan mineralogi yang berikut:

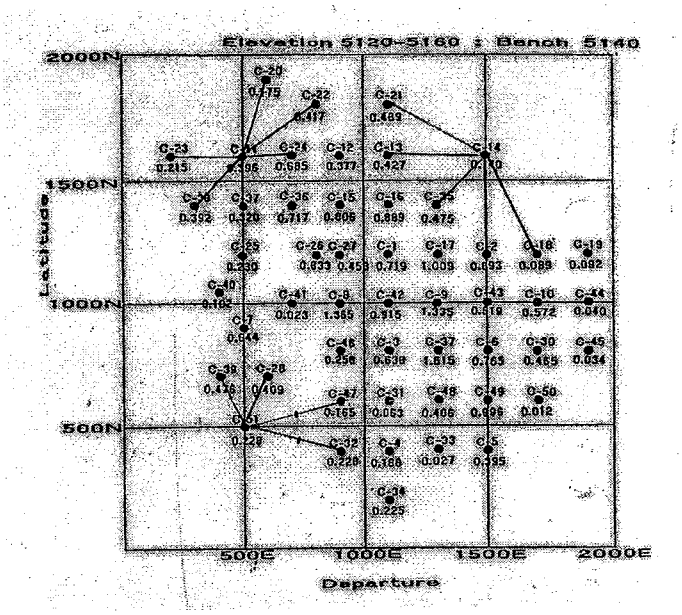
- Pengeluaran yang dijangkakan : 3000 t
- Perolehan (daripada logi) : 70%
- 95% kuarza, 4.5% pirit, 0.5% gold
- Ketebalan (t) : 3 m.

$[\rho_{\text{pirit besi}} = 5.1, \rho_{\text{kuarza}} = 2.65]$

(5 markah)

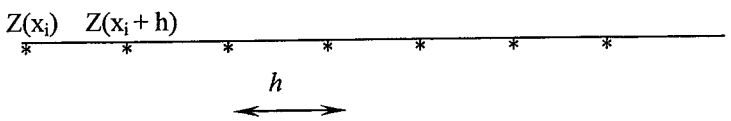
6. [a] Bincangkan fasa-fasa yang perlu dilaksanakan dalam penentuan faktor 'gred purata' dalam contoh kawasan pensampelan yang berikut dengan kegunaan **kaedah-kaedah penilaian bijih statistik** yang berikut:

- kaedah polygon,
- kaedah segitiga,
- kaedah jarak songsang.



(10 markah)

[b] Huraikan bagaimana nilai-nilai untuk penentuan graf **semi-variogram**, $\gamma(h)$, didapati dengan kegunaan agihan titik sampel dengan nilai $Z(x_i)$, $Z(x_i + h)$ ..... $Z(x_i + y)$, dengan jarak persampelan *h*.



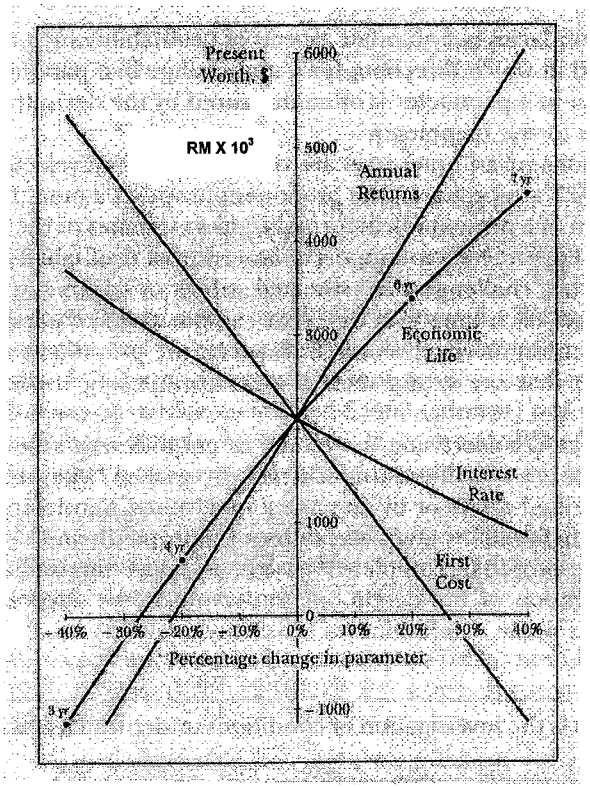
Bincangkan **kelebihan dan kekurangan kegunaan kaedah Geostatistik** jika dibandingkan dengan kaedah statistik klasik dalam penentuan rizab bijih.

(10 markah)

...7/-

7. [a] Huraikan apakah konsep **analisis kepekaan (*sensitivity analysis*)** dan bincangkan kepentingan konsep ini dalam pengurusan ekonomik untuk projek perlombongan.

(8 markah)



Hasil Graf Analisis Kepekaan untuk projek perlombongan yang dicadangkan

[b] Hayat projek perlombongan tersebut ialah 5 tahun. Daripada hasil graf analisis kepekaan di atas, kirakan berapa **tahun tambahan hayat projek** tersebut diperlukan untuk meningkatkan nilai projek tersebut ke dua kali ganda besarnya daripada yang asal?

(4 markah)

[c] Tentukan tahap kekurangan **pendapatan tahunan (*annual returns*)** sebelum projek perlombongan tersebut menjadi tidak ekonomik.

(4 markah)

[d] Kirakan **julat kadar pinjaman bank** untuk projek perlombongan yang dirancangkan untuk mencapai nilai sekurang-kurangnya RM 1,000,000?

(4 markah)

...8/-

PART A

1. *Cashflow for a mining project are as given in the following table*

Year	*Capital Expenditure (RM 000)*	*Gross Revenue (RM 000)*	*Operational Cost (RM 000)*
-2	*1,000*		
-1	*3,000*		
0	*6,000*		
1		*7,000*	*4,000*
2		*7,500*	*4,300*
3		*8,000*	*4,600*
4		*8,500*	*4,900*
5		*9,000*	*5,200*

30% of the capital expenditure is to buy mining land while the remainder is used to develop the mining operation until production

If:-

(i) *The depreciation was done at rate of 20% every year on the remainder capital.*

(ii) *The complete depletion was done equally throughout the mine life.*

(iii) *Royalty are paid at 2% of gross revenue.*

(iv) *income tax are paid at 40%.*

(v) *Capital cost is 10%.*

Calculate:

[a] *the total net income cash flow for the project*

(7 marks)

[b] *the net cash flow present value at capital cost*

(6 marks)

[c] *the discounted cash flow internal rate of return for the project*

(3 marks)

[d] *the payback period*

(2 marks)

[e] *give comment on this project*

(2 marks)

...9/-

2. [a] *Explain what is investment appraisal and name types of investment appraisal.*

(5 marks)

[b] *Discuss three (3) types of investment appraisal. Give their advantage and disadvantage.*

(7 marks)

[c] *Discuss the important thing that you should consider in evaluating a project.*

(4 marks)

[d] *Explain and discuss the technique for estimating capital cost.*

(4 marks)

3. *A mining company, COMMREC Sdn.Bhd. planned to increase their annual production due to good economic trend. The company therefore need to expand the mining operation and processing plant. Two cash flow have been proposed for evaluation:*

Project	*Capital Cost needed (RM)*	*Annual cash flow (RM)*	*Project Life*
X	*5,000,000*	*1,000,000*	*9*
Y	*6,500,000*	*1,250,000*	*9*

If the capital cost is 12%

[a] *Calculate the discounted cash flow internal rate of return for project X and Y*

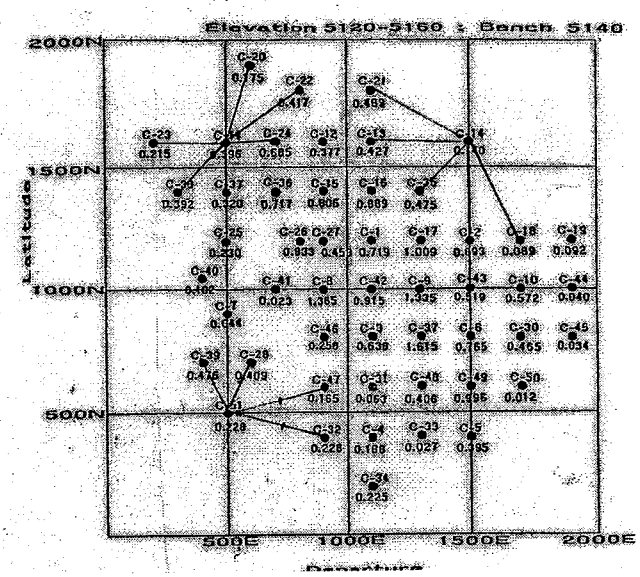
(12 marks)

[b] *Choose which project should be chosen and give reasons*

(8 marks)

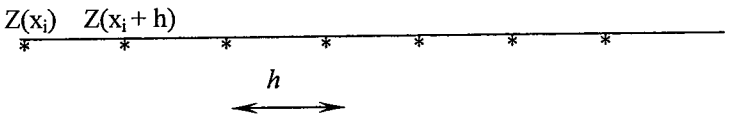
6. [a] *Discuss the steps required in the determination of 'average grade' value using the sampling site shown below by applying the following* ***statistical ore evaluation techniques****:*

- *polygonal method,*
- *triangular technique,*
- *inverse distance method.*



(10 marks)

[b] *Describe how the values for the* ***semi-variogram****, γ(h), are produced from the following distributions of sample points with values* $Z(x_i)$, $Z(x_i + h)$ ..... $Z(x_i + y)$, *at a sampling interval of h.*



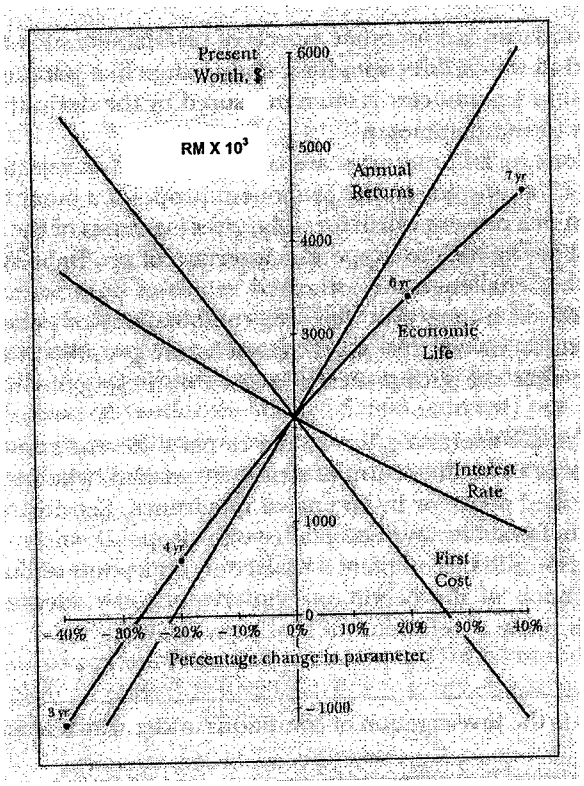
Discuss the ***advantages and limitations in the usage of the geostatistical technique*** *when compared with classical statistical techniques in the economic ore reserve evaluation of a mineral deposit.*

(10 marks)

...13/-

7. [a] *Describe what is '**sensitivity analysis**' and discuss its importance in the economic management of a mining project.*

(8 marks)



Sensitivity Analysis Graph for a proposed mining project.

[b] *The mining project has an estimated 5-year life. From the sensitivity analysis graph for the proposed mine shown above, calculate how many **additional years of life** would double the project's worth?*

(4 marks)

[c] *Determine how much could the **annual returns** decrease before the proposed mining project would become unattractive?*

(4 marks)

[d] *For what **range of interest rates** would the present project worth be at least RM 1,000,000?*

(4 marks)

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APPENDIX 1

(DISCOUNTING FACTOR)

NILAI KINI UNTUK 1 PADA KADAR $r\% = (1+r)^{-n}$

r \ n	TAHUN 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1%	0.9901	0.9803	0.9706	0.9610	0.9515	0.9420	0.9327	0.9235	0.9143	0.9053	0.8963	0.8874	0.8787	0.8700	0.8613	0.8528
2%	0.9804	0.9612	0.9423	0.9238	0.9057	0.8880	0.8706	0.8535	0.8368	0.8203	0.8043	0.7885	0.7730	0.7579	0.7430	0.7284
3%	0.9709	0.9426	0.9151	0.8885	0.8626	0.8375	0.8131	0.7894	0.7664	0.7441	0.7224	0.7014	0.6810	0.6611	0.6419	0.6232
4%	0.9615	0.9246	0.8890	0.8548	0.8219	0.7903	0.7599	0.7307	0.7026	0.6756	0.6496	0.6246	0.6006	0.5775	0.5553	0.5339
5%	0.9524	0.9070	0.8638	0.8227	0.7835	0.7462	0.7107	0.6768	0.6446	0.6139	0.5847	0.5568	0.5303	0.5051	0.4810	0.4581
6%	0.9434	0.8900	0.8396	0.7921	0.7473	0.7050	0.6651	0.6274	0.5919	0.5584	0.5268	0.4970	0.4688	0.4423	0.4173	0.3936
7%	0.9346	0.8734	0.8163	0.7629	0.7130	0.6663	0.6227	0.5820	0.5439	0.5083	0.4751	0.4440	0.4150	0.3878	0.3624	0.3387
8%	0.9259	0.8573	0.7938	0.7350	0.6806	0.6302	0.5835	0.5403	0.5002	0.4632	0.4289	0.3971	0.3677	0.3405	0.3152	0.2919
9%	0.9174	0.8417	0.7722	0.7084	0.6499	0.5963	0.5470	0.5019	0.4604	0.4224	0.3875	0.3555	0.3262	0.2992	0.2745	0.2519
10%	0.9091	0.8264	0.7513	0.6830	0.6209	0.5645	0.5132	0.4665	0.4241	0.3855	0.3505	0.3186	0.2897	0.2633	0.2394	0.2176
11%	0.9009	0.8116	0.7312	0.6587	0.5935	0.5346	0.4817	0.4339	0.3909	0.3522	0.3173	0.2858	0.2575	0.2320	0.2090	0.1883
12%	0.8929	0.7972	0.7118	0.6355	0.5674	0.5066	0.4523	0.4039	0.3606	0.3220	0.2875	0.2567	0.2292	0.2046	0.1827	0.1631
13%	0.8850	0.7831	0.6931	0.6133	0.5428	0.4803	0.4251	0.3762	0.3329	0.2946	0.2607	0.2307	0.2042	0.1807	0.1599	0.1415
14%	0.8772	0.7695	0.6750	0.5921	0.5194	0.4556	0.3996	0.3506	0.3075	0.2697	0.2366	0.2076	0.1821	0.1597	0.1401	0.1229
15%	0.8696	0.7561	0.6575	0.5718	0.4972	0.4323	0.3759	0.3269	0.2843	0.2472	0.2149	0.1869	0.1625	0.1413	0.1229	0.1069
16%	0.8621	0.7432	0.6407	0.5523	0.4761	0.4104	0.3538	0.3050	0.2630	0.2267	0.1954	0.1685	0.1452	0.1252	0.1079	0.0930
17%	0.8547	0.7305	0.6244	0.5337	0.4561	0.3898	0.3332	0.2848	0.2434	0.2080	0.1778	0.1520	0.1299	0.1110	0.0949	0.0811
18%	0.8475	0.7182	0.6086	0.5158	0.4371	0.3704	0.3139	0.2660	0.2255	0.1911	0.1619	0.1372	0.1163	0.0985	0.0835	0.0708
19%	0.8403	0.7062	0.5934	0.4987	0.4190	0.3521	0.2959	0.2487	0.2090	0.1756	0.1476	0.1240	0.1042	0.0876	0.0736	0.0618
20%	0.8333	0.6944	0.5787	0.4823	0.4019	0.3349	0.2791	0.2326	0.1938	0.1615	0.1346	0.1122	0.0935	0.0779	0.0649	0.0541
21%	0.8264	0.6830	0.5645	0.4665	0.3855	0.3186	0.2633	0.2176	0.1799	0.1486	0.1228	0.1015	0.0839	0.0693	0.0573	0.0474
22%	0.8197	0.6719	0.5507	0.4514	0.3700	0.3033	0.2486	0.2038	0.1670	0.1369	0.1122	0.0920	0.0754	0.0618	0.0507	0.0415
23%	0.8130	0.6610	0.5374	0.4369	0.3552	0.2888	0.2348	0.1909	0.1552	0.1262	0.1026	0.0834	0.0678	0.0551	0.0448	0.0364
24%	0.8065	0.6504	0.5245	0.4230	0.3411	0.2751	0.2218	0.1789	0.1443	0.1164	0.0938	0.0757	0.0610	0.0492	0.0397	0.0320
25%	0.8000	0.6400	0.5120	0.4096	0.3277	0.2621	0.2097	0.1678	0.1342	0.1074	0.0859	0.0687	0.0550	0.0440	0.0352	0.0281
26%	0.7937	0.6299	0.4999	0.3968	0.3149	0.2499	0.1983	0.1574	0.1249	0.0992	0.0787	0.0625	0.0496	0.0393	0.0312	0.0248
27%	0.7874	0.6200	0.4882	0.3844	0.3027	0.2383	0.1877	0.1478	0.1164	0.0916	0.0721	0.0568	0.0447	0.0352	0.0277	0.0218
28%	0.7813	0.6104	0.4768	0.3725	0.2910	0.2274	0.1776	0.1388	0.1084	0.0847	0.0662	0.0517	0.0404	0.0316	0.0247	0.0193
29%	0.7752	0.6009	0.4658	0.3611	0.2799	0.2170	0.1682	0.1304	0.1011	0.0784	0.0607	0.0471	0.0365	0.0283	0.0219	0.0170
30%	0.7692	0.5917	0.4552	0.3501	0.2693	0.2072	0.1594	0.1226	0.0943	0.0725	0.0558	0.0429	0.0330	0.0254	0.0195	0.0150
31%	0.7634	0.5827	0.4448	0.3396	0.2592	0.1979	0.1510	0.1153	0.0880	0.0672	0.0513	0.0392	0.0299	0.0228	0.0174	0.0133
32%	0.7576	0.5739	0.4348	0.3294	0.2495	0.1890	0.1432	0.1085	0.0822	0.0623	0.0472	0.0357	0.0271	0.0205	0.0155	0.0118
33%	0.7519	0.5653	0.4251	0.3196	0.2403	0.1807	0.1358	0.1021	0.0768	0.0577	0.0434	0.0326	0.0245	0.0185	0.0139	0.0104
34%	0.7463	0.5569	0.4156	0.3102	0.2315	0.1727	0.1289	0.0962	0.0718	0.0536	0.0400	0.0298	0.0223	0.0166	0.0124	0.0093
35%	0.7407	0.5487	0.4064	0.3011	0.2230	0.1652	0.1224	0.0906	0.0671	0.0497	0.0368	0.0273	0.0202	0.0150	0.0111	0.0082
36%	0.7353	0.5407	0.3975	0.2923	0.2149	0.1580	0.1162	0.0854	0.0628	0.0462	0.0340	0.0250	0.0184	0.0135	0.0099	0.0073
37%	0.7299	0.5328	0.3889	0.2839	0.2072	0.1512	0.1104	0.0806	0.0588	0.0429	0.0313	0.0229	0.0167	0.0122	0.0089	0.0065
38%	0.7246	0.5251	0.3805	0.2757	0.1998	0.1448	0.1049	0.0760	0.0551	0.0399	0.0289	0.0210	0.0152	0.0110	0.0080	0.0058
39%	0.7194	0.5176	0.3724	0.2679	0.1927	0.1386	0.0997	0.0718	0.0516	0.0371	0.0267	0.0192	0.0138	0.0099	0.0072	0.0051
40%	0.7143	0.5102	0.3644	0.2603	0.1859	0.1328	0.0949	0.0678	0.0484	0.0346	0.0247	0.0176	0.0126	0.0090	0.0064	0.0046
41%	0.7092	0.5030	0.3567	0.2530	0.1794	0.1273	0.0903	0.0640	0.0454	0.0322	0.0228	0.0162	0.0115	0.0081	0.0058	0.0041
42%	0.7042	0.4959	0.3492	0.2459	0.1732	0.1220	0.0859	0.0605	0.0426	0.0300	0.0211	0.0149	0.0105	0.0074	0.0052	0.0037
43%	0.6993	0.4890	0.3420	0.2391	0.1672	0.1169	0.0818	0.0572	0.0400	0.0280	0.0196	0.0137	0.0096	0.0067	0.0047	0.0033
44%	0.6944	0.4823	0.3349	0.2326	0.1615	0.1122	0.0779	0.0541	0.0376	0.0261	0.0181	0.0126	0.0087	0.0061	0.0042	0.0029
45%	0.6897	0.4756	0.3280	0.2262	0.1560	0.1076	0.0742	0.0512	0.0353	0.0243	0.0168	0.0116	0.0080	0.0055	0.0038	0.0026
46%	0.6849	0.4691	0.3213	0.2201	0.1507	0.1032	0.0707	0.0484	0.0332	0.0227	0.0156	0.0107	0.0073	0.0050	0.0034	0.0023
47%	0.6803	0.4628	0.3148	0.2142	0.1457	0.0991	0.0674	0.0459	0.0312	0.0212	0.0144	0.0098	0.0067	0.0045	0.0031	0.0021
48%	0.6757	0.4565	0.3085	0.2084	0.1408	0.0952	0.0643	0.0434	0.0294	0.0198	0.0134	0.0091	0.0061	0.0041	0.0028	0.0019
49%	0.6711	0.4504	0.3023	0.2029	0.1362	0.0914	0.0613	0.0412	0.0276	0.0185	0.0124	0.0084	0.0056	0.0038	0.0025	0.0017
50%	0.6667	0.4444	0.2963	0.1975	0.1317	0.0878	0.0585	0.0390	0.0260	0.0173	0.0116	0.0077	0.0051	0.0034	0.0023	0.0015

APPENDIX 2

(COMPOUNDING FACTOR)

r \ n	TAHUN 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1%	1.010	1.020	1.030	1.041	1.051	1.062	1.072	1.083	1.094	1.105	1.116	1.127	1.138	1.149	1.161	1.173
2%	1.020	1.040	1.061	1.082	1.104	1.126	1.149	1.172	1.195	1.219	1.243	1.268	1.294	1.319	1.346	1.373
3%	1.030	1.061	1.093	1.126	1.159	1.194	1.230	1.267	1.305	1.344	1.384	1.426	1.469	1.513	1.558	1.605
4%	1.040	1.082	1.125	1.170	1.217	1.265	1.316	1.369	1.423	1.480	1.539	1.601	1.665	1.732	1.801	1.873
5%	1.050	1.103	1.158	1.216	1.276	1.340	1.407	1.477	1.551	1.629	1.710	1.796	1.886	1.980	2.079	2.183
6%	1.060	1.124	1.191	1.262	1.338	1.419	1.504	1.594	1.689	1.791	1.898	2.012	2.133	2.261	2.397	2.540
7%	1.070	1.145	1.225	1.311	1.403	1.501	1.606	1.718	1.838	1.967	2.105	2.252	2.410	2.579	2.759	2.952
8%	1.080	1.166	1.260	1.360	1.469	1.587	1.714	1.851	1.999	2.159	2.332	2.518	2.720	2.937	3.172	3.426
9%	1.090	1.188	1.295	1.412	1.539	1.677	1.828	1.993	2.172	2.367	2.580	2.813	3.066	3.342	3.642	3.970
10%	1.100	1.210	1.331	1.464	1.611	1.772	1.949	2.144	2.358	2.594	2.853	3.138	3.452	3.797	4.177	4.595
11%	1.110	1.232	1.368	1.518	1.685	1.870	2.076	2.305	2.558	2.839	3.152	3.498	3.883	4.310	4.785	5.311
12%	1.120	1.254	1.405	1.574	1.762	1.974	2.211	2.476	2.773	3.106	3.479	3.896	4.363	4.887	5.474	6.130
13%	1.130	1.277	1.443	1.630	1.842	2.082	2.353	2.658	3.004	3.395	3.836	4.335	4.898	5.535	6.254	7.067
14%	1.140	1.300	1.482	1.689	1.925	2.195	2.502	2.853	3.252	3.707	4.226	4.818	5.492	6.261	7.138	8.137
15%	1.150	1.323	1.521	1.749	2.011	2.313	2.660	3.059	3.518	4.046	4.652	5.350	6.153	7.076	8.137	9.358
16%	1.160	1.346	1.561	1.811	2.100	2.436	2.826	3.278	3.803	4.411	5.117	5.936	6.886	7.988	9.266	10.748
17%	1.170	1.369	1.602	1.874	2.192	2.565	3.001	3.511	4.108	4.807	5.624	6.580	7.699	9.007	10.539	12.330
18%	1.180	1.392	1.643	1.939	2.288	2.700	3.185	3.759	4.435	5.234	6.176	7.288	8.599	10.147	11.974	14.129
19%	1.190	1.416	1.685	2.005	2.386	2 840	3.379	4.021	4.785	5.695	6.777	8.064	9.596	11.420	13.590	16.172
20%	1.200	1.440	1.728	2.074	2.488	2.986	3.583	4.300	5.160	6.192	7.430	8.916	10.699	12.839	15.407	18.488
21%	1.210	1.464	1.772	2.144	2.594	3.138	3.797	4.595	5.560	6.727	8.140	9.850	11.918	14.421	17.449	21.114
22%	1.220	1.488	1.816	2.215	2.703	3.297	4.023	4.908	5.987	7.305	8.912	10.872	13.264	16.182	19.742	24.086
23%	1.230	1.513	1.861	2.289	2.815	3.463	4.259	5.239	6.444	7.926	9.749	11.991	14.749	18.141	22.314	27.446
24%	1.240	1.538	1.907	2.364	2.932	3.635	4.508	5.590	6.931	8.594	10.657	13.215	16.386	20.319	25.196	31.243
25%	1.250	1.563	1.953	2.441	3.052	3.815	4.768	5.960	7.451	9.313	11.642	14.552	18.190	22.737	28.422	35.527
26%	1.260	1.588	2.000	2.520	3.176	4.002	5.042	6.353	8.005	10.086	12.708	16.012	20.175	25.421	32.030	40.358
27%	1.270	1.613	2.048	2.601	3.304	4.196	5.329	6.768	8.595	10.915	13.862	17.605	22.359	28.396	36.062	45.799
28%	1.280	1.638	2.097	2.684	3.436	4.398	5.629	7.206	9.223	11.806	15.112	19.343	24.759	31.691	40.565	51.923
29%	1.290	1.664	2.147	2.769	3.572	4.608	5.945	7.669	9.893	12.761	16.462	21.236	27.395	35.339	45.587	58.808
30%	1.300	1.690	2.197	2.856	3.713	4.827	6.275	8.157	10.604	13.786	17.922	23.298	30.288	39.374	51.186	66.542
31%	1.310	1.716	2.248	2.945	3.858	5.054	6.621	8.673	11.362	14.884	19.498	25.542	33.460	43.833	57.421	75.221
32%	1.320	1.742	2.300	3.036	4.007	5.290	6.983	9.217	12.166	16.060	21.199	27.983	36.937	48.757	64.359	84.954
33%	1.330	1.769	2.353	3.129	4.162	5.535	7.361	9.791	13.022	17.319	23.034	30.635	40.745	54.190	72.073	95.858
34%	1.340	1.796	2.406	3.224	4.320	5.789	7.758	10.395	13.930	18.666	25.012	33.516	44.912	60.182	80.644	108.063
35%	1.350	1.823	2.460	3.322	4.484	6.053	8.172	11.032	14.894	20.107	27.144	36.644	49.470	66.784	90.158	121.714
36%	1.360	1.850	2.515	3.421	4.653	6.328	8.605	11.703	15.917	21.647	29.439	40.037	54.451	74.053	100.713	136.969
37%	1.370	1.877	2.571	3.523	4.826	6.612	9.058	12.410	17.001	23.292	31.910	43.717	59.892	82.052	112.411	154.003
38%	1.380	1.904	2.628	3.627	5.005	6.907	9.531	13.153	18.151	25.049	34.568	47.703	65.831	90.846	125.368	173.008
39%	1.390	1.932	2.686	3.733	5.189	7.213	10.025	13.935	19.370	26.925	37.425	52.021	72.309	100.510	139.708	194.194
40%	1.400	1.960	2.744	3.842	5.378	7.530	10.541	14.758	20.661	28.925	40.496	56.694	79.371	111.120	155.568	217.795
41%	1.410	1.988	2.803	3.953	5.573	7.858	11.080	15.623	22.028	31.059	43.794	61.749	87.066	122.763	173.096	244.065
42%	1.420	2.016	2.863	4.066	5.774	8.198	11.642	16.531	23.474	33.334	47.334	67.214	95.444	135.530	192.453	273.284
43%	1.430	2.045	2.924	4.182	5.980	8.551	12.228	17.486	25.005	35.757	51.132	73.119	104.561	149.522	213.816	305.757
44%	1.440	2.074	2.986	4.300	6.192	8.916	12.839	18.488	26.623	38.338	55.206	79.497	114.475	164.845	237.376	341.822
45%	1.450	2.103	3.049	4.421	6.410	9.294	13.476	19.541	28.334	41.085	59.573	86.381	125.252	181.615	263.342	381.846
46%	1.460	2.132	3.112	4.544	6.634	9.685	14.141	20.645	30.142	44.008	64.251	93.807	136.958	199.959	291.939	426.232
47%	1.470	2.161	3.177	4.669	6.864	10.090	14.833	21.804	32.052	47.117	69.261	101.814	149.667	220.010	323.415	475.420
48%	1.480	2.190	3.242	4.798	7.101	10.509	15.554	23.019	34.069	50.422	74.624	110.444	163.457	241.916	358.035	529.892
49%	1.490	2.220	3.308	4.929	7.344	10.943	16.304	24.294	36.197	53.934	80.362	119.739	178.411	265.832	396.090	590.174
50%	1.500	2.250	3.375	5.062	7.594	11.391	17.086	25.629	38.443	57.665	86.498	129.746	194.620	291.929	437.894	656.841

APPENDIX 3

(NET ANNUITY VALUE)

NILAI KINI ANUITI UNTUK 1 PADA KADAR $r\%$ $\left[= \frac{1 - (1 + r)^{-n}}{r} \right]$

	1%	2%	3%	4%	5%	6%	7%	8%	9%	10%	11%	12%	13%	14%	15%	16%	17%
1	0.9901	0.9804	0.9709	0.9615	0.9524	0.9434	0.9346	0.9259	0.9174	0.9091	0.9009	0.8929	0.8850	0.8772	0.8696	0.8621	0.8547
2	1.9704	1.9416	1.9135	1.8861	1.8594	1.8334	1.8080	1.7833	1.7591	1.7355	1.7125	1.6901	1.6681	1.6467	1.6257	1.6052	1.5852
3	2.9410	2.8839	2.8286	2.7751	2.7232	2.6730	2.6243	2.5771	2.5313	2.4869	2.4437	2.4018	2.3612	2.3216	2.2832	2.2459	2.2096
4	3.9020	3.8077	3.7171	3.6299	3.5460	3.4651	3.3872	3.3121	3.2397	3.1699	3.1024	3.0373	2.9745	2.9137	2.8550	2.7982	2.7432
5	4.8534	4.7135	4.5797	4.4518	4.3295	4.2124	4.1002	3.9927	3.8897	3.7908	3.6959	3.6048	3.5172	3.4331	3.3522	3.2743	3.1993
6	5.7955	5.6014	5.4172	5.2421	5.0757	4.9173	4.7665	4.6229	4.4859	4.3553	4.2305	4.1114	3.9975	3.8887	3.7845	3.6847	3.5892
7	6.7282	6.4720	6.2303	6.0021	5.7864	5.5824	5.3893	5.2064	5.0330	4.8684	4.7122	4.5638	4.4226	4.2883	4.1604	4.0386	3.9224
8	7.6517	7.3255	7.0197	6.7327	6.4632	6.2098	5.9713	5.7466	5.5348	5.3349	5.1461	4.9676	4.7988	4.6389	4.4873	4.3436	4.2072
9	8.5660	8.1622	7.7861	7.4353	7.1078	6.8017	6.5152	6.2469	5.9952	5.7590	5.5370	5.3282	5.1317	4.9464	4.7716	4.6065	4.4506
10	9.4713	8.9826	8.5302	8.1109	7.7217	7.3601	7.0236	6.7101	6.4177	6.1446	5.8892	5.6502	5.4262	5.2161	5.0188	4.8332	4.6586
11	10.3676	9.7868	9.2526	8.7605	8.3064	7.8869	7.4987	7.1390	6.8052	6.4951	6.2065	5.9377	5.6869	5.4527	5.2337	5.0286	4.8364
12	11.2551	10.5753	9.9540	9.3851	8.8633	8.3838	7.9427	7.5361	7.1607	6.8137	6.4924	6.1944	5.9176	5.6603	5.4206	5.1971	4.9884
13	12.1337	11.3484	10.6350	9.9856	9.3936	8.8527	8.3577	7.9038	7.4869	7.1034	6.7499	6.4235	6.1218	5.8424	5.5831	5.3423	5.1183
14	13.0037	12.1062	11.2961	10.5631	9.8986	9.2950	8.7455	8.2442	7.7862	7.3667	6.9819	6.6282	6.3025	6.0021	5.7245	5.4675	5.2293
15	13.8651	12.8493	11.9379	11.1184	10.3797	9.7122	9.1079	8.5595	8.0607	7.6061	7.1909	6.8109	6.4624	6.1422	5.8474	5.5755	5.3242
16	14.7179	13.5777	12.5611	11.6523	10.8378	10.1059	9.4466	8.8514	8.3126	7.8237	7.3792	6.9740	6.6039	6.2651	5.9542	5.6685	5.4053
17	15.5623	14.2919	13.1661	12.1657	11.2741	10.4773	9.7632	9.1216	8.5436	8.0216	7.5488	7.1196	6.7291	6.3729	6.0472	5.7487	5.4746
18	16.3983	14.9920	13.7535	12.6593	11.6896	10.8276	10.0591	9.3719	8.7556	8.2014	7.7016	7.2497	6.8399	6.4674	6.1280	5.8178	5.5339
19	17.2260	15.6785	14.3238	13.1339	12.0853	11.1581	10.3356	9.6036	8.9501	8.3649	7.8393	7.3658	6.9380	6.5504	6.1982	5.8775	5.5845
20	18.0456	16.3514	14.8775	13.5903	12.4622	11.4699	10.5940	9.8181	9.1285	8.5136	7.9633	7.4694	7.0248	6.6231	6.2593	5.9288	5.6278
21	18.8570	17.0112	15.4150	14.0292	12.8212	11.7641	10.8355	10.0168	9.2922	8.6487	8.0751	7.5620	7.1016	6.6870	6.3125	5.9731	5.6648
22	19.6604	17.6580	15.9369	14.4511	13.1630	12.0416	11.0612	10.2007	9.4424	8.7715	8.1757	7.6446	7.1695	6.7429	6.3587	6.0113	5.6964
23	20.4558	18.2922	16.4436	14.8568	13.4886	12.3034	11.2722	10.3711	9.5802	8.8832	8.2664	7.7184	7.2297	6.7921	6.3988	6.0442	5.7234
24	21.2434	18.9139	16.9355	15.2470	13.7986	12.5504	11.4693	10.5288	9.7066	8.9847	8.3481	7.7843	7.2829	6.8351	6.4338	6.0726	5.7465
25	22.0232	19.5235	17.4131	15.6221	14.0939	12.7834	11.6536	10.6748	9.8226	9.0770	8.4217	7.8431	7.3300	6.8729	6.4641	6.0971	5.7662
26	22.7952	20.1210	17.8768	15.9828	14.3752	13.0032	11.8258	10.8100	9.9290	9.1609	8.4881	7.8957	7.3717	6.9061	6.4906	6.1182	5.7831
27	23.5596	20.7069	18.3270	16.3296	14.6430	13.2105	11.9867	10.9352	10.0266	9.2372	8.5478	7.9426	7.4086	6.9352	6.5135	6.1364	5.7975
28	24.3164	21.2813	18.7641	16.6631	14.8981	13.4062	12.1371	11.0511	10.1161	9.3066	8.6016	7.9844	7.4412	6.9607	6.5335	6.1520	5.8099
29	25.0658	21.8444	19.1885	16.9837	15.1411	13.5907	12.2777	11.1584	10.1983	9.3696	8.6501	8.0218	7.4701	6.9830	6.5509	6.1656	5.8204
30	25.8077	22.3965	19.6004	17.2920	15.3725	13.7648	12.4090	11.2578	10.2737	9.4269	8.6938	8.0552	7.4957	7.0027	6.5660	6.1772	5.8294
31	26.5423	22.9377	20.0004	17.5885	15.5928	13.9291	12.5318	11.3498	10.3428	9.4790	8.7331	8.0850	7.5183	7.0199	6.5791	6.1872	5.8371
32	27.2696	23.4683	20.3888	17.8736	15.8027	14.0840	12.6466	11.4350	10.4062	9.5264	8.7686	8.1116	7.5383	7.0350	6.5905	6.1959	5.8437
33	27.9897	23.9886	20.7658	18.1476	16.0025	14.2302	12.7538	11.5139	10.4644	9.5694	8.8005	8.1354	7.5560	7.0482	6.6005	6.2034	5.8493
34	28.7027	24.4986	21.1318	18.4112	16.1929	14.3681	12.8540	11.5869	10.5178	9.6086	8.8293	8.1566	7.5717	7.0599	6.6091	6.2098	5.8541
35	29.4086	24.9986	21.4872	18.6646	16.3742	14.4982	12.9477	11.6546	10.5668	9.6442	8.8552	8.1755	7.5856	7.0700	6.6166	6.2153	5.8582
36	30.1075	25.4888	21.8323	18.9083	16.5469	14.6210	13.0352	11.7172	10.6118	9.6765	8.8786	8.1924	7.5979	7.0790	6.6231	6.2201	5.8617
37	30.7995	25.9695	22.1672	19.1426	16.7113	14.7368	13.1170	11.7752	10.6530	9.7059	8.8996	8.2075	7.6087	7.0868	6.6288	6.2242	5.8647
38	31.4847	26.4406	22.4925	19.3679	16.8679	14.8460	13.1935	11.8289	10.6908	9.7327	8.9186	8.2210	7.6183	7.0937	6.6338	6.2278	5.8673
39	32.1630	26.9026	22.8082	19.5845	17.0170	14.9491	13.2649	11.8786	10.7255	9.7570	8.9357	8.2330	7.6268	7.0997	6.6380	6.2309	5.8695
40	32.8347	27.3555	23.1148	19.7928	17.1591	15.0463	13.3317	11.9246	10.7574	9.7791	8.9511	8.2438	7.6344	7.1050	6.6418	6.2335	5.8713
41	33.4997	27.7995	23.4124	19.9931	17.2944	15.1380	13.3941	11.9672	10.7866	9.7991	8.9649	8.2534	7.6410	7.1097	6.6450	6.2358	5.8729
42	34.1581	28.2348	23.7014	20.1856	17.4232	15.2245	13.4524	12.0067	10.8134	9.8174	8.9774	8.2619	7.6469	7.1138	6.6478	6.2377	5.8743
43	34.8100	28.6616	23.9819	20.3708	17.5459	15.3062	13.5070	12.0432	10.8380	9.8340	8.9886	8.2696	7.6522	7.1173	6.6503	6.2394	5.8755
44	35.4555	29.0800	24.2543	20.5488	17.6628	15.3832	13.5579	12.0771	10.8605	9.8491	8.9988	8.2764	7.6568	7.1205	6.6524	6.2409	5.8765
45	36.0945	29.4902	24.5187	20.7200	17.7741	15.4558	13.6055	12.1084	10.8812	9.8628	9.0079	8.2825	7.6609	7.1232	6.6543	6.2421	5.8773
46	36.7272	29.8923	24.7754	20.8847	17.8801	15.5244	13.6500	12.1374	10.9002	9.8753	9.0161	8.2880	7.6645	7.1256	6.6559	6.2432	5.8781
47	37.3537	30.2866	25.0247	21.0429	17.9810	15.5890	13.6916	12.1643	10.9176	9.8866	9.0235	8.2928	7.6677	7.1277	6.6573	6.2442	5.8787
48	37.9740	30.6731	25.2667	21.1951	18.0772	15.6500	13.7305	12.1891	10.9336	9.8969	9.0302	8.2972	7.6705	7.1296	6.6585	6.2450	5.8792
49	38.5881	31.0521	25.5017	21.3415	18.1687	15.7076	13.7668	12.2122	10.9482	9.9063	9.0362	8.3010	7.6730	7.1312	6.6596	6.2457	5.8797
50	39.1961	31.4236	25.7298	21.4822	18.2559	15.7619	13.8007	12.2335	10.9617	9.9148	9.0417	8.3045	7.6752	7.1327	6.6605	6.2463	5.8801