

**QUEENS UNIVERSITY
KINGSTON, ONTARIO**

APSC221 – Fall 2010

SECTIONS A and X

PROJECT MANAGEMENT AND ECONOMICS

EXAM – 17 December 2010

INSTRUCTORS – Sandra Smith and Ron Smith

This exam constitutes 45% of your final mark

INSTRUCTIONS:

1. Time available **3 Hours**
2. Answers to **ALL** questions must be written in the answer booklet that is provided. **DO NOT USE RED COLOUR** for your presentation in any form, written or pictorial (This colour is reserved for marking your submission)
3. Use of University-approved, non-programmable, non-communicating calculators will be allowed **ONLY**.
4. Equation sheets and interest tables are provided at the back of the exam.
5. A Standard Normal Distribution table is provided at the back of the exam.
6. The exam is out of a total of 90 points. Answer all questions.
7. **If doubt exists as to the interpretation of any question, the candidate is urged to submit with the answer paper a clear statement of any assumptions made. The proctor or the instructor may not be able to answer your query during the test.**
8. **Marks will be deducted** if appropriate interest factors, their designations and appropriate values of interest rate (i) and period (N) are not indicated. You are strongly encouraged to provide cash flow diagrams where appropriate.
9. There will be **penalties if any of the above instructions** are not followed.
10. **YOU MUST HAND IN BOTH YOUR ANSWER BOOKLET AND THIS EXAM PAPER ON COMPLETION OF THE TEST!**

Question 1 (10 points) – Enterprise Planning, Project Management & Change Management

Read the following scenario carefully, and then answer the questions below.

It is now three years since you graduated from Queen's University with an engineering degree in *<insert your degree here>*. Shortly after graduation you and four of your classmates started an engineering design firm structured as a legal partnership.

Recently you have been working as the lead engineer on a proposal for the design and prototyping of an environmentally friendly *<insert your product here>* for the Federal government. The government has released a detailed product specification outlining the mandatory technical requirements as well as the quality standards that must be met. Your company is confident that it can design and build a prototype that fulfills the requirements. Your project proposal includes a detailed work breakdown structure, a fixed-price cost and a schedule. You have estimated that it will cost \$650,000 and take roughly 9 months to complete the work. Your company uses a 20% profit ratio for medium risk projects such as this, implying that your bid on the proposal must be at least \$780,000. Your company anticipates beginning work on another large project, but that project does not begin for at least a year from now. Therefore you feel comfortable stating in the proposal that the work can be completed in 10 months. If your company wins this contract, you will be appointed as the project manager.

In parallel with this activity, another one of your partners is working on the restructuring of your company. You and your partners are buying another small engineering company in order to acquire several new engineers and a larger marketing department. The merged company will be relocated in a modern office complex. In addition, the partnership will be dissolved and the new company will be incorporated with each partner holding an equal share in equity ownership.

A month after submitting your proposal, your company is awarded the contract. It is going to be a busy year!

Answer the following questions. Complete sentences are NOT required, just list the answers.

- a. As project manager of the government contract there are three key elements of the project that you must manage and control. List all three. **(3 marks)**
- b. Throughout the management of the project, several organizational changes will make your job as project manager more difficult. List two of these changes, and for each identify them as one of the following: strategic, technological, structural or cultural. **(2 marks)**
- c. List two benefits that your company derives by restructuring from a partnership to a corporation. **(2 marks)**
- d. When the restructuring of your company is complete, is it a public or private corporation, and why? **(2 marks)**
- e. As companies grow, what benefit is there in going "public"? List one benefit. **(1 mark)**

QUESTION 2 (10 Marks) – Project Planning

The table below lists the optimistic, most likely and pessimistic estimates of completion times in WEEKS for 8 major tasks in a construction project. Earlier analysis has already determined those tasks on the critical path, and those not on the critical path; they are identified accordingly in the table below.

Activity	Critical Path Task	Optimistic Times (weeks)	Most Likely Times (weeks)	Pessimistic Times (weeks)
A	Yes	5	7	10
B	No	2.5	3	4
C	Yes	8	9	13
D	No	2	2	3
E	Yes	3	4	7
F	No	1	1	2
G	Yes	4	5	12
H	Yes	4	6	8

- Compute the project expected completion time in **weeks**. (3 marks)
- Compute the project variance in **days**. (2 marks)
- What is the probability of completing the project within 90% of the expected completion time? (in other words 10% sooner than expected) (2 marks)
- The project manager wants a 95% assurance that the schedule presented to senior management will be met on time. What estimate of total number of **weeks** for completion should the project manager present to senior management? (3 marks)

QUESTION 3 (10 Marks) – Financial Accounting & Weighted Average Cost of Capital

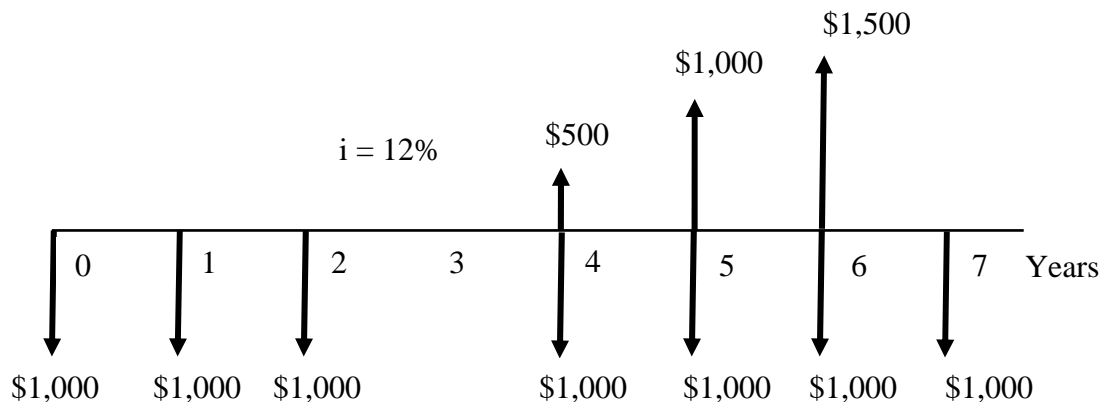
Fraser Phraser operates a small publishing company. He is interested in getting a loan for expanding his computer systems. The bank has asked Phraser to supply them with his financial statements from the past two years. His statements appear at the back of the exam (on page 12).

- a. Calculate the following financial ratios by reproducing the table below (**do not answer on this test paper**). (5 marks)

Financial Ratio	2009	2010
Current ratio		
Acid test		
Equity ratio		
Return on Equity		
Return on Assets		

- b. Comment on Phraser's financial position with regard to the loan based on the results of financial ratio analysis. In other words, would you recommend the loan, why or why not? (2 marks)
- c. The formula for weighted-average cost of capital is provided in the formula sheet. The tax rate for Phraser is given as 50%. The average cost of debt has been 7.5% and the average cost of equity has been 10%. Compute Phraser's WACC for 2009 and 2010. (2 marks)
- d. Why is debt financing for Phraser so much cheaper than equity financing? (1 mark)

QUESTION 4 (10 Marks) –Time Value of Money & Cash Flow Analysis



- What is the present worth of the cash flow diagram above? **(5 marks)**
- A company is negotiating a business loan that will require them to make quarterly loan payments with quarterly compounding; in other words payments are made and interest is compounded 4 times per year. The company decides that it can afford an effective yearly interest rate of 8%. What is the maximum quarterly interest rate that the company can afford for this loan? Compute your answer to the nearest one hundredth of a percent. **(5 marks)**

QUESTION 5 (10 Marks) –Comparison Methods & Cash Flow Scoping

South Frontenac Township is evaluating two alternative methods of disposing of municipal waste. The first involves developing a landfill site near the town of Sydenham. Costs of the site include a start-up cost of \$1,000,000, a closedown costs 30 years from now of \$100,000, and operating costs of \$20,000 per year. Starting in 10 years, it is expected that there will be revenues from user fees of \$30,000 per year. The alternative is to ship the waste out of the region. An area firm will agree to a long-term contract to dispose of the waste for \$140,000 per year.

- Using an appropriate comparison method, which waste disposal alternative should the municipality pursue if their MARR is 12%? **(6 marks)**

In the scenario above, the estimated yearly operating cost of \$20,000 for the public landfill includes many different cost elements. The municipality must pay a subcontractor a fee for every bag of garbage picked up and delivered to the landfill. The municipality must also expect that a portion of its administrative staff's time will be dedicated to handling customer enquiries and complaints. In addition, the municipality must purchase special insurance to cover them for any liabilities in the event of public contamination of the neighboring water supply.

- From the yearly operating costs above, provide one example of each of the following types of costs: **(4 marks)**
 - A fixed cost;
 - A variable cost;
 - A direct cost; and
 - An indirect cost.

QUESTION 6 (10 Marks) – Replacement Analysis

A construction company is preparing their capital budget estimates and are considering replacing some of their used equipment. Two different pieces of equipment are under study. The companies yearly MARR is 6%.

- a) A crane was purchased 6 years ago for \$1,500,000. While it has 4 more years of useful life, its operations and maintenance (O&M) costs are expected to rise sharply in the last years of its life in order to keep it safe to operate. The crane has an estimated current salvage value of \$325,000 and this value is expected to decrease by \$75,000 over each of the next 4 years until it reaches its scrap value of \$25,000. The O&M costs for the crane are estimated to be \$30,000 for this year, \$33,000 in two years, and \$40,000 in 3 years and \$50,000 in the final year.
 - i. Construct a table of salvage values and O&M costs for the next 4 years. **(1 mark)**
 - ii. The company is convinced that the economic life has not yet been reached. Using the data from above, determine if the economic life of the crane will be reached within the next 4 years. **(3 marks)**
 - iii. If the company were to use a cyclic replacement policy for the crane, what replacement cycle would you recommend? **(1 mark)**
- b) The company also owns a large pavement roller. While they have not owned it for many years, the company is already getting offers from different equipment vendors to replace it with a newer model. The company has used equivalent annual cost analysis in preparing the data below. The tables below list the relevant equivalent annual cost data for the existing roller and two potential replacement rollers.
 - i. What is the economic life of each of the three rollers? **(3 marks)**
 - ii. Assuming that this data remains valid for at least 10 years, should the company replace the existing roller, and if so when? Justify your recommendation. **(2 marks)**

Existing Pavement Roller			
Year	EAC _{Capital}	EAC _{O&M}	EAC _{Total}
0			
1	\$ 10,000	\$ 3,300	\$ 13,300
2	\$ 8,000	\$ 3,795	\$ 11,795
3	\$ 6,400	\$ 4,364	\$ 10,764
4	\$ 5,120	\$ 5,019	\$ 10,139
5	\$ 4,096	\$ 5,772	\$ 9,868
6	\$ 3,277	\$ 6,637	\$ 9,914
7	\$ 2,621	\$ 7,633	\$ 10,255
8	\$ 2,097	\$ 8,778	\$ 10,875
9	\$ 1,678	\$ 10,095	\$ 11,772
10	\$ 1,342	\$ 11,609	\$ 12,951

New Model 1 Roller			
Year	EAC _{Capital}	EAC _{O&M}	EAC _{Total}
0			
1	\$ 15,000	\$ 1,500	\$ 16,500
2	\$ 13,200	\$ 1,755	\$ 14,955
3	\$ 11,816	\$ 2,053	\$ 13,869
4	\$ 10,222	\$ 2,402	\$ 12,624
5	\$ 8,995	\$ 2,811	\$ 11,806
6	\$ 7,916	\$ 3,289	\$ 11,205
7	\$ 6,966	\$ 3,848	\$ 10,814
8	\$ 6,130	\$ 4,502	\$ 10,632
9	\$ 5,395	\$ 5,267	\$ 10,662
10	\$ 4,747	\$ 6,163	\$ 10,910

New Model 2 Roller			
Year	EAC _{Capital}	EAC _{O&M}	EAC _{Total}
0			
1	\$ 20,000	\$ 1,700	\$ 21,700
2	\$ 16,800	\$ 1,989	\$ 18,789
3	\$ 14,112	\$ 2,327	\$ 16,439
4	\$ 11,854	\$ 2,723	\$ 14,577
5	\$ 9,957	\$ 3,186	\$ 13,143
6	\$ 8,364	\$ 3,727	\$ 12,091
7	\$ 7,026	\$ 4,361	\$ 11,387
8	\$ 5,902	\$ 5,102	\$ 11,004
9	\$ 4,958	\$ 5,969	\$ 10,927
10	\$ 4,164	\$ 6,984	\$ 11,149
11	\$ 3,498	\$ 8,172	\$ 11,670
12	\$ 2,938	\$ 9,561	\$ 12,499

QUESTION 7 (10 Marks) – Taxes & Depreciation

You started your own delivery business in 2005. Over the following years, your transactions for CCA Class 10 assets ($d = 30\%$) consisted of the following:

Year	Item	Activity	Amount
Jun 17, 2005	2 delivery trucks	Purchase	\$75,000
Dec 8, 2005	3 utility trailers	Purchase	\$9,000
Jan 1, 2006	1 used van	Purchase	\$15,000
Jul 19, 2007		No Activity	
Oct 23, 2008	1 used van	Purchase	\$9,000
May 1, 2008	1 used van	Sale	\$2,500
Dec 8, 2009	2 utility trailers	Sale	\$1,400

- a) We see from the table above, that the company purchased three identical utility trailers in 2005 for \$3,000 each. Assume that the trailers have a service life of 6 years at which time each has a scrap value of \$350.
- Compute the BV of a single trailer after 4 years using straight-line depreciation. **(1 mark)**
 - Compute the book value of a single trailer after 4 years using declining balance depreciation, and the depreciation rate of 30% from above. **(2 marks)**
 - Based upon the sales data above in 2009, which model has best matched the utility trailer's market value and why? **(2 marks)**
- b) Compute the Undepreciated Capital Costs (UCC) for the period 2005 - 2009. Make sure that you show your UCC_{Opening} and UCC_{Ending} calculations. Present your answer by reproducing the following table in your answer booklet **(do not answer on this test paper)**. **(5 marks)**

Year	Adjustments		UCC_{Opening}	CCA	UCC_{Ending}
	Purchases	Sales			
2005					
2006					
2007					
2008					
2009					

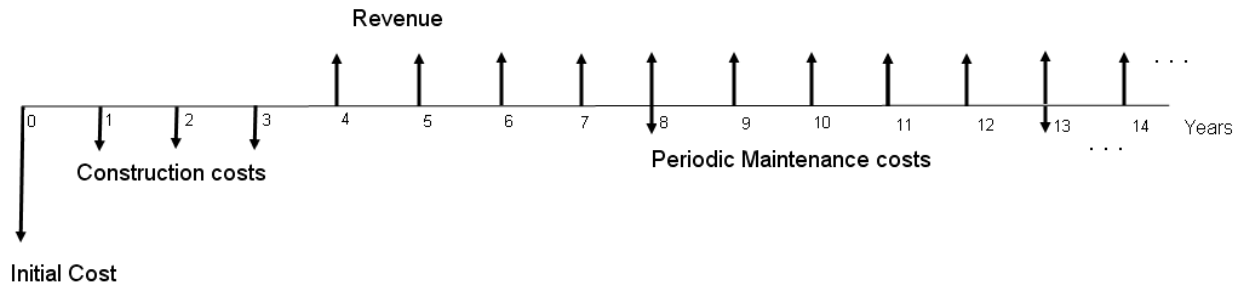
QUESTION 8 (10 Marks) – Inflation and Risk Management

A group of farmers is considering building an irrigation system from a water supply in some nearby mountains. They want to build a concrete reservoir with a steel pipe system. The first construction cost would be \$200,000 with (actual) annual maintenance costs of \$2,000. They expect the irrigation system will bring them \$22,000 per year in additional (real) revenues due to better crop production. Their real dollar MARR is 4% and they anticipate inflation to be 2.885% per year. Assume that the reservoir will have a 20 year life.

- a. What is the future worth (at the end of year 20) of this project in real dollars? **(5 marks)**
- b. In order to ensure a guaranteed market for their produce, the farmers sign long-term multi-year contracts with distributors wherein they agree to provide produce at fixed prices.
 - i) Briefly explain why inflation is a major risk to the farmers. **(1 mark)**
 - ii) What two parameters are required to quantify this risk? {These are the same two general parameters that are required to quantify any risk. } **(2 marks)**
 - iii) Identify two different mitigation strategies the farmers may consider to control this risk. **(2 marks)**

QUESTION 9 (10 Marks) – Sensitivity Analysis & Risk Analysis

The provincial government is planning to build a toll bridge across the Catarqui in Kingston. The cost elements include an upfront initial cost, construction costs in the first three years, yearly revenues beginning in year four, and periodic maintenance every five years after the bridge is completed. The bridge is assumed to be an infinite life project. The general cash flow diagram is provided, and the table below lists the high, most likely and low estimates for all costs as well as the discount rate (MARR).



Cost Element	High Estimate	Most Likely Estimate	Low Estimate
Initial Cost	\$2,500,000	\$1,500,000	\$900,000
Yearly Construction Cost (Years 1, 2 and 3)	\$350,000	\$250,000	\$200,000
Yearly Revenue (beginning in year 4)	\$400,000	\$350,000	\$250,000
Periodic Maintenance (every 5 years beginning in year 8)	\$175,000	\$150,000	\$125,000
MARR	12%	6%	4%

- Provide a general expression for the present worth of the project. Do not use any numbers, just representative cost variables, and interest factors. **(1 mark)**
- Complete a scenario analysis for the best-case, most-likely case and worst-case scenarios. For each cost element and the MARR, be careful to consider which is “best” versus which is “worst”. **(5 marks)**
- The government estimates that the best-case scenario has a 15% probability of occurrence, while there is a 35% likelihood that all of the worst-case costs may occur. Therefore, the most likely case is estimated to have a 50% probability of occurrence.
 - Compute the expected value of the present worth of the project. **(2 marks)**
 - What is your recommendation; should the government proceed? Why or why not? **(2 marks)**

INTEREST FACTORS

Interest Factor	Formula
$(F/P, i, n)$	$(1+i)^n$
$(P/F, i, n)$	$\frac{1}{(1+i)^n}$
$(F/A, i, n)$	$\frac{(1+i)^n - 1}{i}$
$(A/F, i, n)$	$\frac{i}{(1+i)^n - 1}$
$(P/A, i, n)$	$\frac{(1+i)^n - 1}{i(1+i)^n}$
$(A/P, i, n)$	$\frac{i(1+i)^n}{(1+i)^n - 1}$
$(A/G, i, n)$	$\frac{1}{i} - \frac{n}{(1+i)^n - 1}$
$(P/G, i, n)$	$\frac{(1+i)^n - in - 1}{i^2(1+i)^n}$

To calculate effective interest rates:

$$i_e = (1 + r/m)^m - 1$$

$$P = \lim_{N \rightarrow \infty} A(P / A, i, N) = A \lim_{N \rightarrow \infty} \left[\frac{(1+i)^N - 1}{i(1+i)^N} \right] = \frac{A}{i}$$

For Scheduling:

$$t = (a + 4m + b)/6, \quad \sigma^2 = [(b - a)/6]^2, \quad Z = (X - \mu)/\sigma$$

Depreciation

$$D_{sl(n)} = \frac{P - S}{N} \quad BV_{sl(n)} = P - n \left(\frac{P - S}{N} \right)$$

$$D_{db(n)} = BV_{db(n-1)} d \quad BV_{db(n)} = P(1 - d)^n$$

Inflation:

$$\text{\$Actual} = \text{\$Real} (1+f)^N$$

$$(1+i) = (1+i') (1+f)$$

Financial Ratios:

$$\text{working capital} = \text{current assets} - \text{current liabilities}$$

$$\text{current ratio} = \text{current assets} / \text{current liabilities}$$

$$\text{acid test ratio} = \text{quick assets} / \text{current liabilities}$$

$$\text{equity ratio} = \text{total equity} / (\text{total liabilities} + \text{total equity})$$

$$\text{return on assets} = \text{net income} / \text{total assets}$$

$$\text{return on equity} = \text{net income} / \text{total equity}$$

$$\text{inventory turnover ratio} = \text{sales} / \text{inventories}$$

$$\text{debt to capital employed } (\lambda) = \text{total debt} / (\text{total debt} + \text{equity})$$

Weighted-Average Cost of Capital:

$$WACC = \lambda (1-t)i_b + (1-\lambda)e_a$$

Where λ is the ratio of total debt (**short and long term**) to total debt plus equity (in other words the debt to capital employed ratio from above),

t is the tax rate,

i_b is the cost of debt financing, and

e_a is the cost of equity financing.

Risk Analysis:

$$\text{Expected value:} \quad E(X) = \sum_i x_i p(x_i)$$

Fraser Phraser Company Financial Data

Phraser Company
Comparative Balance Sheets
for the Years Ending in 2009 and 2010
(in thousands of dollars)

	2,009	2,010
Assets		
Current Assets		
Cash	22,500	1,250
Accounts receivable	31,250	40,000
Inventories	72,500	113,750
Sub-Total	126,250	155,000
Long-Term Assets		
Land	50,000	65,000
Plant and equipment	175,000	250,000
Less: Accumulated depreciation	70,000	95,000
Net plant and equipment	105,000	155,000
Sub-Total	155,000	220,000
Total Assets	281,250	375,000

Liabilities and Owner's Equity		
Current Liabilities		
Accounts payable	26,250	55,000
Working capital Loan	42,500	117,500
Sub-Total	68,750	172,500
Long-Term Liabilities		
Mortgage Loan	71,875	57,375
Sub-Total	71,875	57,375
Owner's Equity		
Common shares	78,750	78,750
Retained earnings	61,875	66,375
Sub-Total	140,625	145,125
Total Liabilities and Owner's Equity	281,250	375,000

Income Statements (in thousands of dollars)		
	2,009	2,010
Revenues		
Sales	156,250	200,000
Costs of goods sold	93,750	120,000
Net revenue	62,500	80,000
Expenses		
Operating	41,875	46,250
Depreciation	5,625	12,500
Interest	3,750	7,625
Sub-Total	51,250	66,375
Income Before Taxes	11,250	13,625
Income taxes (50%)	5,625	6,813
Net Income	5,625	6,812

i = 4.0%

n	[F/P, i, n]	[P/F, i, n]	[F/A, i, n]	[A/F, i, n]	[P/A, i, n]	[A/P, i, n]	[A/G, i, n]	[P/G, i, n]
1	1.0400	0.9615	1.0000	1.0000	0.9615	1.0400	0.0000	0.0000
2	1.0816	0.9246	2.0400	0.4902	1.8861	0.5302	0.4902	0.9246
3	1.1249	0.8890	3.1216	0.3203	2.7751	0.3603	0.9739	2.7025
4	1.1699	0.8548	4.2465	0.2355	3.6299	0.2755	1.4510	5.2670
5	1.2167	0.8219	5.4163	0.1846	4.4518	0.2246	1.9216	8.5547
6	1.2653	0.7903	6.6330	0.1508	5.2421	0.1908	2.3857	12.5062
7	1.3159	0.7599	7.8983	0.1266	6.0021	0.1666	2.8433	17.0657
8	1.3686	0.7307	9.2142	0.1085	6.7327	0.1485	3.2944	22.1806
9	1.4233	0.7026	10.5828	0.0945	7.4353	0.1345	3.7391	27.8013
10	1.4802	0.6756	12.0061	0.0833	8.1109	0.1233	4.1773	33.8814
11	1.5395	0.6496	13.4864	0.0741	8.7605	0.1141	4.6090	40.3772
12	1.6010	0.6246	15.0258	0.0666	9.3851	0.1066	5.0343	47.2477
13	1.6651	0.6006	16.6268	0.0601	9.9856	0.1001	5.4533	54.4546
14	1.7317	0.5775	18.2919	0.0547	10.5631	0.0947	5.8659	61.9618
15	1.8009	0.5553	20.0236	0.0499	11.1184	0.0899	6.2721	69.7355
16	1.8730	0.5339	21.8245	0.0458	11.6523	0.0858	6.6720	77.7441
17	1.9479	0.5134	23.6975	0.0422	12.1657	0.0822	7.0656	85.9581
18	2.0258	0.4936	25.6454	0.0390	12.6593	0.0790	7.4530	94.3498
19	2.1068	0.4746	27.6712	0.0361	13.1339	0.0761	7.8342	102.8933
20	2.1911	0.4564	29.7781	0.0336	13.5903	0.0736	8.2091	111.5647
21	2.2788	0.4388	31.9692	0.0313	14.0292	0.0713	8.5779	120.3414
22	2.3699	0.4220	34.2480	0.0292	14.4511	0.0692	8.9407	129.2024
23	2.4647	0.4057	36.6179	0.0273	14.8568	0.0673	9.2973	138.1284
24	2.5633	0.3901	39.0826	0.0256	15.2470	0.0656	9.6479	147.1012
25	2.6658	0.3751	41.6459	0.0240	15.6221	0.0640	9.9925	156.1040
30	3.2434	0.3083	56.0849	0.0178	17.2920	0.0578	11.6274	201.0618
35	3.9461	0.2534	73.6522	0.0136	18.6646	0.0536	13.1198	244.8768
40	4.8010	0.2083	95.0255	0.0105	19.7928	0.0505	14.4765	286.5303
50	7.1067	0.1407	152.6671	0.0066	21.4822	0.0466	16.8122	361.1638
60	10.5196	0.0951	237.9907	0.0042	22.6235	0.0442	18.6972	422.9966

i = 6.0%

n	[F/P, i, n]	[P/F, i, n]	[F/A, i, n]	[A/F, i, n]	[P/A, i, n]	[A/P, i, n]	[A/G, i, n]	[P/G, i, n]
1	1.0600	0.9434	1.0000	1.0000	0.9434	1.0600	0.0000	0.0000
2	1.1236	0.8900	2.0600	0.4854	1.8334	0.5454	0.4854	0.8900
3	1.1910	0.8396	3.1836	0.3141	2.6730	0.3741	0.9612	2.5692
4	1.2625	0.7921	4.3746	0.2286	3.4651	0.2886	1.4272	4.9455
5	1.3382	0.7473	5.6371	0.1774	4.2124	0.2374	1.8836	7.9345
6	1.4185	0.7050	6.9753	0.1434	4.9173	0.2034	2.3304	11.4594
7	1.5036	0.6651	8.3938	0.1191	5.5824	0.1791	2.7676	15.4497
8	1.5938	0.6274	9.8975	0.1010	6.2098	0.1610	3.1952	19.8416
9	1.6895	0.5919	11.4913	0.0870	6.8017	0.1470	3.6133	24.5768
10	1.7908	0.5584	13.1808	0.0759	7.3601	0.1359	4.0220	29.6023
11	1.8983	0.5268	14.9716	0.0668	7.8869	0.1268	4.4213	34.8702
12	2.0122	0.4970	16.8699	0.0593	8.3838	0.1193	4.8113	40.3369
13	2.1329	0.4688	18.8821	0.0530	8.8527	0.1130	5.1920	45.9629
14	2.2609	0.4423	21.0151	0.0476	9.2950	0.1076	5.5635	51.7128
15	2.3966	0.4173	23.2760	0.0430	9.7122	0.1030	5.9260	57.5546
16	2.5404	0.3936	25.6725	0.0390	10.1059	0.0990	6.2794	63.4592
17	2.6928	0.3714	28.2129	0.0354	10.4773	0.0954	6.6240	69.4011
18	2.8543	0.3503	30.9057	0.0324	10.8276	0.0924	6.9597	75.3569
19	3.0256	0.3305	33.7600	0.0296	11.1581	0.0896	7.2867	81.3062
20	3.2071	0.3118	36.7856	0.0272	11.4699	0.0872	7.6051	87.2304
21	3.3996	0.2942	39.9927	0.0250	11.7641	0.0850	7.9151	93.1136
22	3.6035	0.2775	43.3923	0.0230	12.0416	0.0830	8.2166	98.9412
23	3.8197	0.2618	46.9958	0.0213	12.3034	0.0813	8.5099	104.7007
24	4.0489	0.2470	50.8156	0.0197	12.5504	0.0797	8.7951	110.3812
25	4.2919	0.2330	54.8645	0.0182	12.7834	0.0782	9.0722	115.9732
30	5.7435	0.1741	79.0582	0.0126	13.7648	0.0726	10.3422	142.3588
35	7.6861	0.1301	111.4348	0.0090	14.4982	0.0690	11.4319	165.7427
40	10.2857	0.0972	154.7620	0.0065	15.0463	0.0665	12.3590	185.9568
50	18.4202	0.0543	290.3359	0.0034	15.7619	0.0634	13.7964	217.4574
60	32.9877	0.0303	533.1282	0.0019	16.1614	0.0619	14.7909	239.0428

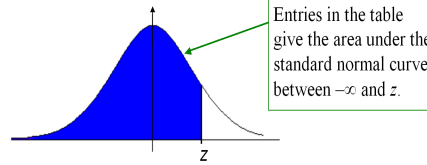
i = 7.0%

n	[F/P, i, n]	[P/F, i, n]	[F/A, i, n]	[A/F, i, n]	[P/A, i, n]	[A/P, i, n]	[A/G, i, n]	[P/G, i, n]
1	1.0700	0.9346	1.0000	1.0000	0.9346	1.0700	0.0000	0.0000
2	1.1449	0.8734	2.0700	0.4831	1.8080	0.5531	0.4831	0.8734
3	1.2250	0.8163	3.2149	0.3111	2.6243	0.3811	0.9549	2.5060
4	1.3108	0.7629	4.4399	0.2252	3.3872	0.2952	1.4155	4.7947
5	1.4026	0.7130	5.7507	0.1739	4.1002	0.2439	1.8650	7.6467
6	1.5007	0.6663	7.1533	0.1398	4.7665	0.2098	2.3032	10.9784
7	1.6058	0.6227	8.6540	0.1156	5.3893	0.1856	2.7304	14.7149
8	1.7182	0.5820	10.2598	0.0975	5.9713	0.1675	3.1465	18.7889
9	1.8385	0.5439	11.9780	0.0835	6.5152	0.1535	3.5517	23.1404
10	1.9672	0.5083	13.8164	0.0724	7.0236	0.1424	3.9461	27.7156
11	2.1049	0.4751	15.7836	0.0634	7.4987	0.1334	4.3296	32.4665
12	2.2522	0.4440	17.8885	0.0559	7.9427	0.1259	4.7025	37.3506
13	2.4098	0.4150	20.1406	0.0497	8.3577	0.1197	5.0648	42.3302
14	2.5785	0.3878	22.5505	0.0443	8.7455	0.1143	5.4167	47.3718
15	2.7590	0.3624	25.1290	0.0398	9.1079	0.1098	5.7583	52.4461
16	2.9522	0.3387	27.8881	0.0359	9.4466	0.1059	6.0897	57.5271
17	3.1588	0.3166	30.8402	0.0324	9.7632	0.1024	6.4110	62.5923
18	3.3799	0.2959	33.9990	0.0294	10.0591	0.0994	6.7225	67.6219
19	3.6165	0.2765	37.3790	0.0268	10.3356	0.0968	7.0242	72.5991
20	3.8697	0.2584	40.9955	0.0244	10.5940	0.0944	7.3163	77.5091
21	4.1406	0.2415	44.8652	0.0223	10.8355	0.0923	7.5990	82.3393
22	4.4304	0.2257	49.0057	0.0204	11.0612	0.0904	7.8725	87.0793
23	4.7405	0.2109	53.4361	0.0187	11.2722	0.0887	8.1369	91.7201
24	5.0724	0.1971	58.1767	0.0172	11.4693	0.0872	8.3923	96.2545
25	5.4274	0.1842	63.2490	0.0158	11.6536	0.0858	8.6391	100.6765
30	7.6123	0.1314	94.4608	0.0106	12.4090	0.0806	9.7487	120.9718
35	10.6766	0.0937	138.2369	0.0072	12.9477	0.0772	10.6687	138.1353
40	14.9745	0.0668	199.6351	0.0050	13.3317	0.0750	11.4233	152.2928
50	29.4570	0.0339	406.5289	0.0025	13.8007	0.0725	12.5287	172.9051
60	57.9464	0.0173	813.5204	0.0012	14.0392	0.0712	13.2321	185.7677

i = 12.0%

n	[F/P, i, n]	[P/F, i, n]	[F/A, i, n]	[A/F, i, n]	[P/A, i, n]	[A/P, i, n]	[A/G, i, n]	[P/G, i, n]
1	1.1200	0.8929	1.0000	1.0000	0.8929	1.1200	0.0000	0.0000
2	1.2544	0.7972	2.1200	0.4717	1.6901	0.5917	0.4717	0.7972
3	1.4049	0.7118	3.3744	0.2963	2.4018	0.4163	0.9246	2.2208
4	1.5735	0.6355	4.7793	0.2092	3.0373	0.3292	1.3589	4.1273
5	1.7623	0.5674	6.3528	0.1574	3.6048	0.2774	1.7746	6.3970
6	1.9738	0.5066	8.1152	0.1232	4.1114	0.2432	2.1720	8.9302
7	2.2107	0.4523	10.0890	0.0991	4.5638	0.2191	2.5515	11.6443
8	2.4760	0.4039	12.2997	0.0813	4.9676	0.2013	2.9131	14.4714
9	2.7731	0.3606	14.7757	0.0677	5.3282	0.1877	3.2574	17.3563
10	3.1058	0.3220	17.5487	0.0570	5.6502	0.1770	3.5847	20.2541
11	3.4785	0.2875	20.6546	0.0484	5.9377	0.1684	3.8953	23.1288
12	3.8960	0.2567	24.1331	0.0414	6.1944	0.1614	4.1897	25.9523
13	4.3635	0.2292	28.0291	0.0357	6.4235	0.1557	4.4683	28.7024
14	4.8871	0.2046	32.3926	0.0309	6.6282	0.1509	4.7317	31.3624
15	5.4736	0.1827	37.2797	0.0268	6.8109	0.1468	4.9803	33.9202
16	6.1304	0.1631	42.7533	0.0234	6.9740	0.1434	5.2147	36.3670
17	6.8660	0.1456	48.8837	0.0205	7.1196	0.1405	5.4353	38.6973
18	7.6900	0.1300	55.7497	0.0179	7.2497	0.1379	5.6427	40.9080
19	8.6128	0.1161	63.4397	0.0158	7.3658	0.1358	5.8375	42.9979
20	9.6463	0.1037	72.0524	0.0139	7.4694	0.1339	6.0202	44.9676
21	10.8038	0.0926	81.6987	0.0122	7.5620	0.1322	6.1913	46.8188
22	12.1003	0.0826	92.5026	0.0108	7.6446	0.1308	6.3514	48.5543
23	13.5523	0.0738	104.6029	0.0096	7.7184	0.1296	6.5010	50.1776
24	15.1786	0.0659	118.1552	0.0085	7.7843	0.1285	6.6406	51.6929
25	17.0001	0.0588	133.3339	0.0075	7.8431	0.1275	6.7708	53.1046
30	29.9599	0.0334	241.3327	0.0041	8.0552	0.1241	7.2974	58.7821
35	52.7996	0.0189	431.6635	0.0023	8.1755	0.1223	7.6577	62.6052
40	93.0510	0.0107	767.0914	0.0013	8.2438	0.1213	7.8988	65.1159
50	289.0022	0.0035	2400.0182	0.0004	8.3045	0.1204	8.1597	67.7624
60	897.5969	0.0011	7471.6411	0.0001	8.3240	0.1201	8.2664	68.8100

Standard Normal Distribution Table



Z	0.0000	0.0100	0.0200	0.0300	0.0400	0.0500	0.0600	0.0700	0.0800	0.0900
-3.0000	0.0013	0.0013	0.0013	0.0012	0.0012	0.0011	0.0011	0.0011	0.0010	0.0010
-2.9000	0.0019	0.0018	0.0018	0.0017	0.0016	0.0016	0.0015	0.0015	0.0014	0.0014
-2.8000	0.0026	0.0025	0.0024	0.0023	0.0023	0.0022	0.0021	0.0021	0.0020	0.0019
-2.7000	0.0035	0.0034	0.0033	0.0032	0.0031	0.0030	0.0029	0.0028	0.0027	0.0026
-2.6000	0.0047	0.0045	0.0044	0.0043	0.0041	0.0040	0.0039	0.0038	0.0037	0.0036
-2.5000	0.0062	0.0060	0.0059	0.0057	0.0055	0.0054	0.0052	0.0051	0.0049	0.0048
-2.4000	0.0082	0.0080	0.0078	0.0075	0.0073	0.0071	0.0069	0.0068	0.0066	0.0064
-2.3000	0.0107	0.0104	0.0102	0.0099	0.0096	0.0094	0.0091	0.0089	0.0087	0.0084
-2.2000	0.0139	0.0136	0.0132	0.0129	0.0125	0.0122	0.0119	0.0116	0.0113	0.0110
-2.1000	0.0179	0.0174	0.0170	0.0166	0.0162	0.0158	0.0154	0.0150	0.0146	0.0143
-2.0000	0.0228	0.0222	0.0217	0.0212	0.0207	0.0202	0.0197	0.0192	0.0188	0.0183
-1.9000	0.0287	0.0281	0.0274	0.0268	0.0262	0.0256	0.0250	0.0244	0.0239	0.0233
-1.8000	0.0359	0.0351	0.0344	0.0336	0.0329	0.0322	0.0314	0.0307	0.0301	0.0294
-1.7000	0.0446	0.0436	0.0427	0.0418	0.0409	0.0401	0.0392	0.0384	0.0375	0.0367
-1.6000	0.0548	0.0537	0.0526	0.0516	0.0505	0.0495	0.0485	0.0475	0.0465	0.0455
-1.5000	0.0668	0.0655	0.0643	0.0630	0.0618	0.0606	0.0594	0.0582	0.0571	0.0559
-1.4000	0.0808	0.0793	0.0778	0.0764	0.0749	0.0735	0.0721	0.0708	0.0694	0.0681
-1.3000	0.0968	0.0951	0.0934	0.0918	0.0901	0.0885	0.0869	0.0853	0.0838	0.0823
-1.2000	0.1151	0.1131	0.1112	0.1093	0.1075	0.1056	0.1038	0.1020	0.1003	0.0985
-1.1000	0.1357	0.1335	0.1314	0.1292	0.1271	0.1251	0.1230	0.1210	0.1190	0.1170
-1.0000	0.1587	0.1562	0.1539	0.1515	0.1492	0.1469	0.1446	0.1423	0.1401	0.1379
-0.9000	0.1841	0.1814	0.1788	0.1762	0.1736	0.1711	0.1685	0.1660	0.1635	0.1611
-0.8000	0.2119	0.2090	0.2061	0.2033	0.2005	0.1977	0.1949	0.1922	0.1894	0.1867
-0.7000	0.2420	0.2389	0.2358	0.2327	0.2296	0.2266	0.2236	0.2206	0.2177	0.2148
-0.6000	0.2743	0.2709	0.2676	0.2643	0.2611	0.2578	0.2546	0.2514	0.2483	0.2451
-0.5000	0.3085	0.3050	0.3015	0.2981	0.2946	0.2912	0.2877	0.2843	0.2810	0.2776
-0.4000	0.3446	0.3409	0.3372	0.3336	0.3300	0.3264	0.3228	0.3192	0.3156	0.3121
-0.3000	0.3821	0.3783	0.3745	0.3707	0.3669	0.3632	0.3594	0.3557	0.3520	0.3483
-0.2000	0.4207	0.4168	0.4129	0.4090	0.4052	0.4013	0.3974	0.3936	0.3897	0.3859
-0.1000	0.4602	0.4562	0.4522	0.4483	0.4443	0.4404	0.4364	0.4325	0.4286	0.4247
0.0000	0.5000	0.4960	0.4920	0.4880	0.4840	0.4801	0.4761	0.4721	0.4681	0.4641
0.0000	0.5000	0.5040	0.5080	0.5120	0.5160	0.5199	0.5239	0.5279	0.5319	0.5359
0.1000	0.5398	0.5438	0.5478	0.5517	0.5557	0.5596	0.5636	0.5675	0.5714	0.5753
0.2000	0.5793	0.5832	0.5871	0.5910	0.5948	0.5987	0.6026	0.6064	0.6103	0.6141
0.3000	0.6179	0.6217	0.6255	0.6293	0.6331	0.6368	0.6406	0.6443	0.6480	0.6517
0.4000	0.6554	0.6591	0.6628	0.6664	0.6700	0.6736	0.6772	0.6808	0.6844	0.6879
0.5000	0.6915	0.6950	0.6985	0.7019	0.7054	0.7088	0.7123	0.7157	0.7190	0.7224
0.6000	0.7257	0.7291	0.7324	0.7357	0.7389	0.7422	0.7454	0.7486	0.7517	0.7549
0.7000	0.7580	0.7611	0.7642	0.7673	0.7704	0.7734	0.7764	0.7794	0.7823	0.7852
0.8000	0.7881	0.7910	0.7939	0.7967	0.7995	0.8023	0.8051	0.8078	0.8106	0.8133
0.9000	0.8159	0.8186	0.8212	0.8238	0.8264	0.8289	0.8315	0.8340	0.8365	0.8389
1.0000	0.8413	0.8438	0.8461	0.8485	0.8508	0.8531	0.8554	0.8577	0.8599	0.8621
1.1000	0.8643	0.8665	0.8686	0.8708	0.8729	0.8749	0.8770	0.8790	0.8810	0.8830
1.2000	0.8849	0.8869	0.8888	0.8907	0.8925	0.8944	0.8962	0.8980	0.8997	0.9015
1.3000	0.9032	0.9049	0.9066	0.9082	0.9099	0.9115	0.9131	0.9147	0.9162	0.9177
1.4000	0.9192	0.9207	0.9222	0.9236	0.9251	0.9265	0.9279	0.9292	0.9306	0.9319
1.5000	0.9332	0.9345	0.9357	0.9370	0.9382	0.9394	0.9406	0.9418	0.9429	0.9441
1.6000	0.9452	0.9463	0.9474	0.9484	0.9495	0.9505	0.9515	0.9525	0.9535	0.9545
1.7000	0.9554	0.9564	0.9573	0.9582	0.9591	0.9599	0.9608	0.9616	0.9625	0.9633
1.8000	0.9641	0.9649	0.9656	0.9664	0.9671	0.9678	0.9686	0.9693	0.9699	0.9706
1.9000	0.9713	0.9719	0.9726	0.9732	0.9738	0.9744	0.9750	0.9756	0.9761	0.9767
2.0000	0.9772	0.9778	0.9783	0.9788	0.9793	0.9798	0.9803	0.9808	0.9812	0.9817
2.1000	0.9821	0.9826	0.9830	0.9834	0.9838	0.9842	0.9846	0.9850	0.9854	0.9857
2.2000	0.9861	0.9864	0.9868	0.9871	0.9875	0.9878	0.9881	0.9884	0.9887	0.9890
2.3000	0.9893	0.9896	0.9898	0.9901	0.9904	0.9906	0.9909	0.9911	0.9913	0.9916
2.4000	0.9918	0.9920	0.9922	0.9925	0.9927	0.9929	0.9931	0.9932	0.9934	0.9936
2.5000	0.9938	0.9940	0.9941	0.9943	0.9945	0.9946	0.9948	0.9949	0.9951	0.9952
2.6000	0.9953	0.9955	0.9956	0.9957	0.9959	0.9960	0.9961	0.9962	0.9963	0.9964
2.7000	0.9965	0.9966	0.9967	0.9968	0.9969	0.9970	0.9971	0.9972	0.9973	0.9974
2.8000	0.9974	0.9975	0.9976	0.9977	0.9977	0.9978	0.9979	0.9979	0.9980	0.9981
2.9000	0.9981	0.9982	0.9982	0.9983	0.9984	0.9984	0.9985	0.9985	0.9986	0.9986
3.0000	0.9987	0.9987	0.9987	0.9988	0.9988	0.9989	0.9989	0.9989	0.9990	0.9990