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Concordia University
Engineering and Computer Science

COURSE: Engineering Management Principles and Economics **NUMBER:** ENGR 301 **SECTION:** R	
EXAMINATION: Midterm	**DATE:** February 14, 2012 **TIME:** 14:15hrs – 17:30hrs
INSTRUCTOR: Christopher J. Willis *PhD, CAPM, P.Eng*	
MATERIALS ALLOWED: Non-programmable Calculator & Writing Instruments.	

SPECIAL INSTRUCTIONS:

1. **This is a closed-book exam with duration of 70 minutes.**
2. Write your name and registration number at the top of each page.
3. **Answer all questions by circling the correct answer and using the space provided for calculations.**
4. Each multiple-choice question has one correct answer.
5. The available points for each question is given in [ ] brackets. **The total is 35 points**.
6. **Do not remove sheets from this booklet.**

1. Project Management is: [1]
   a. The integration of the critical path method and the earned value management system.
   b. The application of knowledge, skills, tools and techniques to project activities to meet project requirements.
   c. The application of knowledge, skills, wisdom, science and art to organizational activities to achieve operational excellence.
   d. A subset of most engineering and other technical disciplines.

2. Project Managers have the highest authority in: [1]
   a. Functional organizations.
   b. Matrix organizations.
   c. Projectized organizations.
   d. None of the above.

3. Which one of the following contract types has the lowest risk to the owner? [1]
   a. Unit price.
   b. Cost plus.
   c. Lump sum.
   d. Construction management.

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4. The first build activity cannot start until the first design activity is completed in: [1]
   a. Traditional project delivery method.
   b. Phased project delivery method.
   c. Fast track project delivery method.
   d. None of the above.

5. A project is: [1]
   a. A set of sequential activities performed in a process or system.
   b. A revenue generating activity that needs to be accomplished while achieving customer satisfaction.
   c. An ongoing endeavor undertaken to meet customer or market requirements.
   d. A temporary endeavor undertaken to create a unique product or service.

6. Which of the following is NOT true about project stakeholders? [1]
   a. They are all individuals and organizations that are actively supportive of the project.
   b. They are all individuals and organizations actively involved in the project.
   c. They are all individuals and organizations whose interests may be affected as a result of project execution.
   d. They are all individuals and organizations that may exert influence over the project.

7. Which one of the following costs is usually disregarded in Engineering Economic Analysis? [1]
   a. Opportunity costs.
   b. Variable costs.
   c. Sunk costs.
   d. Marginal costs.

8. In cost control earned value refers to: [1]
   a. How much money of the budget should have been spent in view of the planned cost of work.
   b. How much money of the budget should have been spent in view of the amount of work performed.
   c. How much money was actually spent for work already performed.
   d. None of the above.

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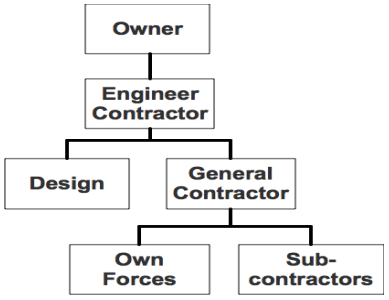
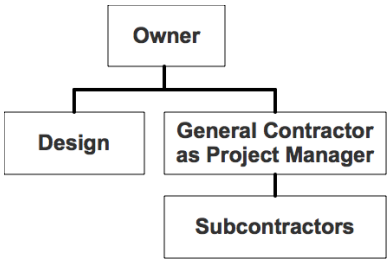
9. Which one of the following flow charts best illustrates an Owner-Builder project delivery system? [1]

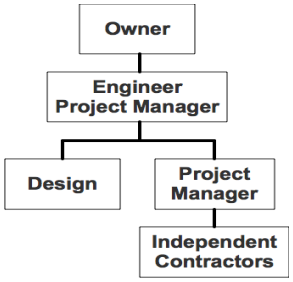
a.



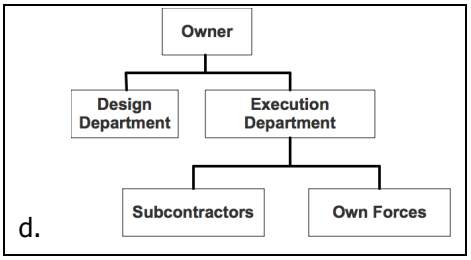
b.



c.



d.



10. Indicate whether the following statement is True or False. [1]

In terms of estimating accuracy, as the percentage of engineering / design complete increases, the accuracy of estimates begin to decrease.

TRUE FALSE

11. Indicate whether the following statement is True or False. [1]

As a sole trader your personal assets cannot be seized to pay off your business debts.

TRUE FALSE

12. Which statement is NOT associated with sunk costs? [1]

a. Money already spent.

b. Past decision.

c. Cost of the least feasible alternative.

d. Should be disregarded in engineering economic analysis.

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13. How much would $3000 deposited in a bank account be worth after 5 years at 2.75% interest? [1]

    a. $2,224,731

    b. $3435

    c. $3,412

    d. $44,250

14. Indicate whether the following statement is True or False. [1]

    As the level of detail in an estimate increases, the cost of making the estimate also increases.

    TRUE FALSE

15. Which of the following statements is TRUE about the WBS? [1]

    a. The WBS is deliverable-oriented.

    b. The WBS is an unstructured list of activities in chart form.

    c. The WBS is the same as an Organizational Breakdown Structure.

    d. The WBS refers to the Bill of Material (BOM).

16. Which one of the following is NOT a cost estimating technique? [1]

    a. The learning curve.

    b. Standard costs.

    c. Earned value.

    d. None of the above.

17. The economic analysis decision making process includes all of the following EXCEPT: [1]

    a. Recognize the problem.

    b. Construct model.

    c. Audit the process.

    d. Find out what the biggest competitor is doing.

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The following questions refer to the AON diagram provided on page 6. Do a forward pass, backward pass, and total float calculations (durations are in days); clearly showing the ES, EF, LS and LF for each activity. Use an early start of 0 for the first activity, and a late finish of the last activity equal to its early finish. Answer the following questions based on the outcome of the forward and backward pass.

18. The project's duration is: [2]

a. 22 days

b. 19 days

c. 38 days

d. 61 days

19. The LF of activity C is: [1]

a. Day 8

b. Day 11

c. Day 10

d. Non of the above

20. The early finish of activity L is: [1]

a. 14 days

b. 20 days

c. 18 days

d. Non of the above

21. The total float of activity G is: [1]

a. 3 days

b. 0 days

c. 5 days

d. 2 days

22. State critical path(s) of the project: [1]

A-B-F-J-M and A-D-H-L-M

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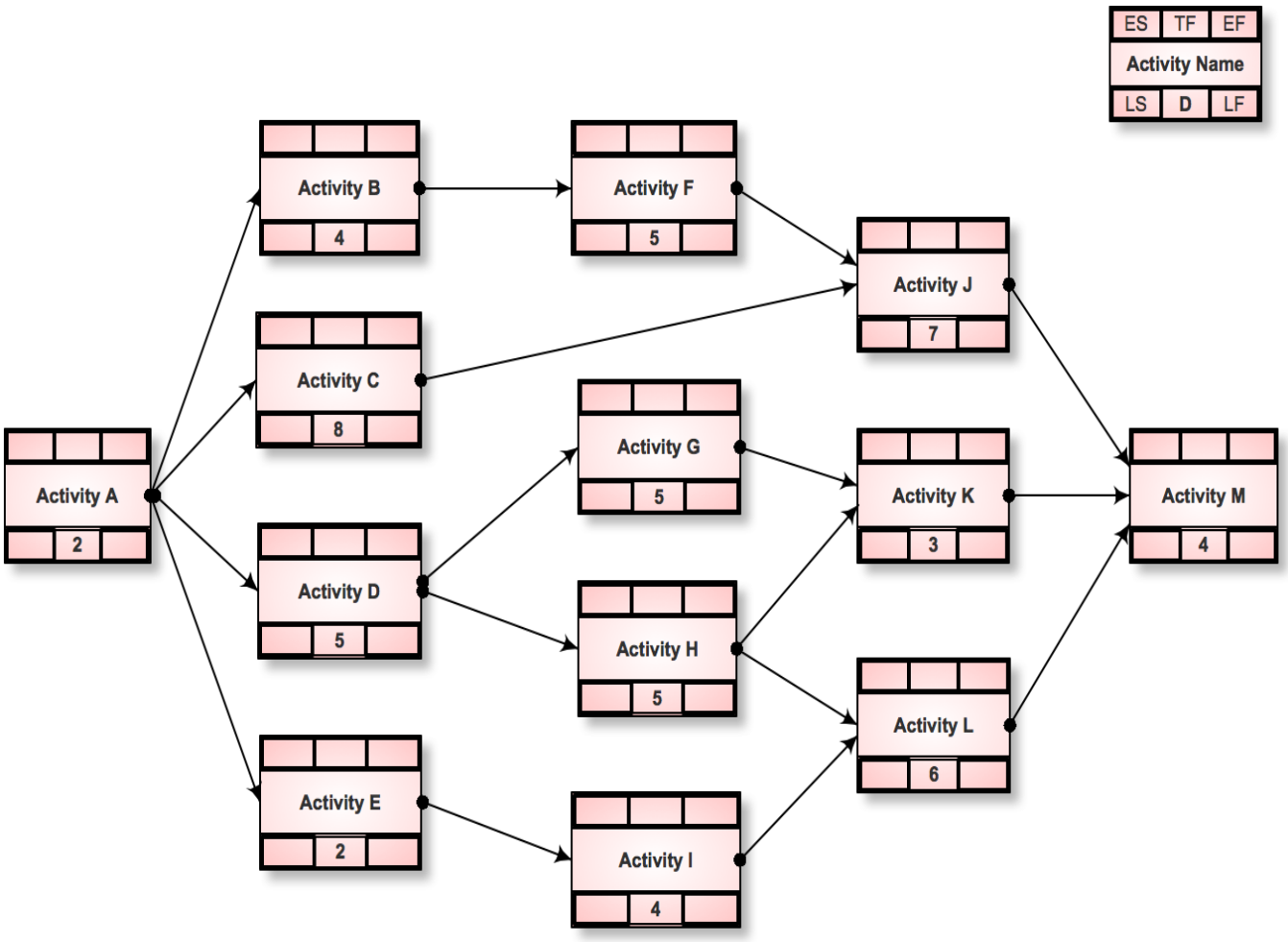
23. If the duration of "activity I" is increased by 4 days, by how many days will the project's overall duration increase? [1]

a. 0 days

b. 4 days

c. 6 days

d. 2 days



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Questions 24 to 28 are based on the following situation:

The sum of $285,000 was budgeted for the excavation of 120,000m^3 of earth on a construction site. At this point in time 95,000m^3 of excavation is complete and the recorded expenditure is $237,237. The schedule at this point in time was to excavate 90,000m^3 with a cost of $213,750.

Space for Earned Values Calculations

BAC = $285,000 ACWP= $237,237 BCWS= $213,750

BCWP = 95,000/120000 * $285,000 = $225,625

CV = BCWP – ACWP = $225,625 - $237,237 = -$11,612

SV = BCWP – BCWS = $225,625 - $213,750 = $11,875

ETC = BAC – EV = $285,000 - $225,625 = $59,375

EAC = ETC + ACWP = $59,371 + $237,237 = $296,612

24. The earned value of the project at this point in time is: [1]

a. $237,237

b. $225,625

c. $213,750

d. $230,750

25. The cost variance of the project at this point in time is: [1]

a. -$44,763

b. $0

c. $11,875

d. -$11,612

26. The schedule variance of the project at this point in time is: [1]

a. -$44,763

b. $0

c. $11,875

d. -$11,612

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27. Assuming that variances are 'atypical', i.e. ETC = BAC - EV, the EAC for this project is: [1]

a. $296,612

b. $261,613

c. $308,487

d. $285,000

28. Which one of the following statements best describes the current performance of the project? [2]

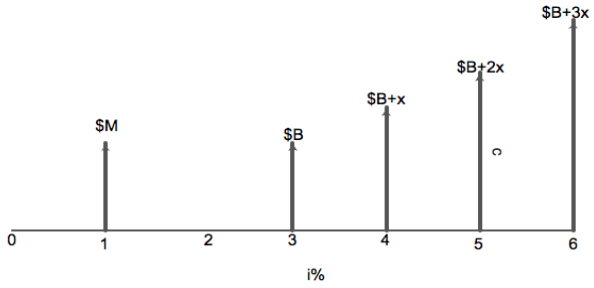
a. The project is currently over budget and behind schedule

b. The project is currently below budget and ahead schedule

c. The project is currently below budget and behind schedule

d. The project is currently over budget and ahead of schedule

29. Which one of the following expressions establishes economic equivalence of the cash flows at t=2? [2]



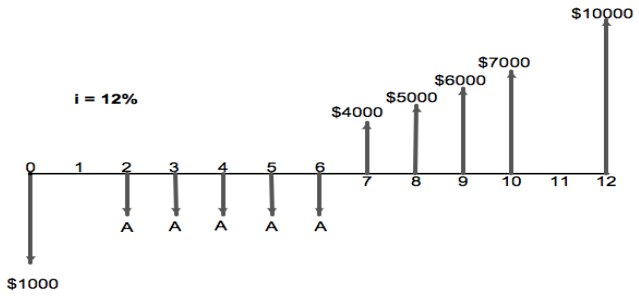
a. M(F/P,i%,2)+$B(P/A,i%,5)+x(P/G,i%,5)

b. M(F/P,i%,1)+$B(P/A,i%,4)+x(P/G,i%,5)

c. M(F/P,i%,1)+$B(P/F,i%,3)+ $B+x(P/F,i%,4)+$B+2x(P/F,i%,5)+$B+3x(P/F,i%,6)

d. M(F/P,i%1)+[$B+x(A/G,i%,4)](P/A,i%,4)

30. From the cash flow diagram, find the value of A that will establish the economic equivalence with the given deposit and withdrawals at an interest rate of 12%. [5]



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Space for question 29 calculations

To find "A" we can determine a future value at t=6 that is equivalent to the deposits of "A" and $1000 at t=0. This future amount at t=6 is equivalent to the withdrawals that commence at t=7.

An amount at t=6 that is equivalent to the deposits:

$1000(F/P,12%,6) + A(F/A,12%,5) ----------(1)

An amount at t=6 that is equivalent to the withdrawals commencing at t=7

$4000(P/A,12%,4) + $1000(P/G,12%,4 + $10,000(P/F,12%,6) ----------(2)

Equating (1) and (2) and solving for "A"

$1000(F/P,12%,6)+A(F/A,12%,5)=$4000(P/A,12%,4)+$1000(P/G,12%,4+$10,000(P/F,12%,6)

$1000(1.974) + A(6.353) = $4000(3.037) + $1000(4.127) + $10000(0.5066)

$1974 + 6.353A = $21341

A = ($21341 - $1974)/6.353 = $3048

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12% Compound Interest Factors 12%

	Single Payment		Uniform Payment Series				Arithmetic Gradient		
	Compound Amount Factor	Present Worth Factor	Sinking Fund Factor	Capital Recovery Factor	Compound Amount Factor	Present Worth Factor	Gradient Uniform Series	Gradient Present Worth	
	Find *F* Given *P*	Find *P* Given *F*	Find *A* Given *F*	Find *A* Given *P*	Find *F* Given *A*	Find *P* Given *A*	Find *A* Given *G*	Find *P* Given *G*	
n	*F/P*	*P/F*	*A/F*	*A/P*	*F/A*	*P/A*	*A/G*	*P/G*	*n*
1	1.120	.8929	1.0000	1.1200	1.000	0.893	0	0	**1**
2	1.254	.7972	.4717	.5917	2.120	1.690	0.472	0.797	**2**
3	1.405	.7118	.2963	.4163	3.374	2.402	0.925	2.221	**3**
4	1.574	.6355	.2092	.3292	4.779	3.037	1.359	4.127	**4**
5	1.762	.5674	.1574	.2774	6.353	3.605	1.775	6.397	**5**
6	1.974	.5066	.1232	.2432	8.115	4.111	2.172	8.930	**6**
7	2.211	.4523	.0991	.2191	10.089	4.564	2.551	11.644	**7**
8	2.476	.4039	.0813	.2013	12.300	4.968	2.913	14.471	**8**
9	2.773	.3606	.0677	.1877	14.776	5.328	3.257	17.356	**9**
10	3.106	.3220	.0570	.1770	17.549	5.650	3.585	20.254	**10**
11	3.479	.2875	.0484	.1684	20.655	5.938	3.895	23.129	**11**
12	3.896	.2567	.0414	.1614	24.133	6.194	4.190	25.952	**12**
13	4.363	.2292	.0357	.1557	28.029	6.424	4.468	28.702	**13**
14	4.887	.2046	.0309	.1509	32.393	6.628	4.732	31.362	**14**
15	5.474	.1827	.0268	.1468	37.280	6.811	4.980	33.920	**15**
16	6.130	.1631	.0234	.1434	42.753	6.974	5.215	36.367	**16**
17	6.866	.1456	.0205	.1405	48.884	7.120	5.435	38.697	**17**
18	7.690	.1300	.0179	.1379	55.750	7.250	5.643	40.908	**18**
19	8.613	.1161	.0158	.1358	63.440	7.366	5.838	42.998	**19**
20	9.646	.1037	.0139	.1339	72.052	7.469	6.020	44.968	**20**
21	10.804	.0926	.0122	.1322	81.699	7.562	6.191	46.819	**21**
22	12.100	.0826	.0108	.1308	92.503	7.645	6.351	48.554	**22**
23	13.552	.0738	.00956	.1296	104.603	7.718	6.501	50.178	**23**
24	15.179	.0659	.00846	.1285	118.155	7.784	6.641	51.693	**24**
25	17.000	.0588	.00750	.1275	133.334	7.843	6.771	53.105	**25**
26	19.040	.0525	.00665	.1267	150.334	7.896	6.892	54.418	**26**
27	21.325	.0469	.00590	.1259	169.374	7.943	7.005	55.637	**27**
28	23.884	.0419	.00524	.1252	190.699	7.984	7.110	56.767	**28**
29	26.750	.0374	.00466	.1247	214.583	8.022	7.207	57.814	**29**
30	29.960	.0334	.00414	.1241	241.333	8.055	7.297	58.782	**30**
31	33.555	.0298	.00369	.1237	271.293	8.085	7.381	59.676	**31**
32	37.582	.0266	.00328	.1233	304.848	8.112	7.459	60.501	**32**
33	42.092	.0238	.00292	.1229	342.429	8.135	7.530	61.261	**33**
34	47.143	.0212	.00260	.1226	384.521	8.157	7.596	61.961	**34**
35	52.800	.0189	.00232	.1223	431.663	8.176	7.658	62.605	**35**
40	93.051	.0107	.00130	.1213	767.091	8.244	7.899	65.116	**40**
45	163.988	.00610	.00074	.1207	1 358.2	8.283	8.057	66.734	**45**
50	289.002	.00346	.00042	.1204	2 400.0	8.304	8.160	67.762	**50**
55	509.321	.00196	.00024	.1202	4 236.0	8.317	8.225	68.408	**55**
60	897.597	.00111	.00013	.1201	7 471.6	8.324	8.266	68.810	**60**
65	1 581.9	.00063	.00008	.1201	13 173.9	8.328	8.292	69.058	**65**
70	2 787.8	.00036	.00004	.1200	23 223.3	8.330	8.308	69.210	**70**
75	4 913.1	.00020	.00002	.1200	40 933.8	8.332	8.318	69.303	**75**
80	8 658.5	.00012	.00001	.1200	72 145.7	8.332	8.324	69.359	**80**
85	15 259.2	.00007	.00001	.1200	127 151.7	8.333	8.328	69.393	**85**
90	26 891.9	.00004		.1200	224 091.1	8.333	8.330	69.414	**90**
95	47 392.8	.00002		.1200	394 931.4	8.333	8.331	69.426	**95**
100	83 522.3	.00001		.1200	696 010.5	8.333	8.332	69.434	**100**

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Factor	**Symbol**	**Factor**
Single sum, present worth factor	(P/F, i, n)	$(1+i)^{-n}$
Single sum, future worth factor	(F/P, i, n)	$(1+i)^{n}$
Uniform series, present worth factor	(P/A, i, n)	$\frac{(1+i)^{n}-1}{i(1+i)^{n}}$
Capital recovery factor	(A/P, i, n)	$\frac{i(1+i)^{n}}{(1+i)^{n}-1}$
Uniform series, future worth factor	(F/A, i, n)	$\frac{(1+i)^{n}-1}{i}$
Sinking fund factor	(A/F, i, n)	$\frac{i}{(1+i)^{n}-1}$
Gradient series, present worth factor	(P/G, i, n)	$\frac{[1-(1+ni)(1+i)^{-n}]}{i^{2}}$
Gradient to uniform series factor	(A/G, i, n)	$\frac{(1+i)^{n}-(1+ni)}{i[(1+i)^{n}-1]}$
Geometric series, present worth factor	(P/A, g, i, n)	$\frac{[1-(1+g)^{n}(1+i)^{-n}]}{i-g}$ for $i \neq g$ $n(1+i)^{-1}$ for $i=g$