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UNIVERSITI TUN HUSSEIN ONN MALAYSIA

**FINAL EXAMINATION
SEMESTER II
SESSION 2013/2014**

**COURSE NAME : CONSTRUCTION PLANNING
AND SCHEDULING**
COURSE CODE : BFP 40103
PROGRAMME : 4 BFF
EXAMINATION DATE : JUNE 2014
DURATION : 3 HOURS
INSTRUCTION : ANSWER ALL QUESTIONS

THIS QUESTION PAPER CONSISTS OF SEVEN (7) PAGES

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- Q1** (a) Construction project life cycle can be broken down into 4 phases namely; Project Initiation, Project Planning, Project Execution and Project Closure.
- (i) Define the meaning of project life cycle (1 marks)
 - (ii) Briefly explain the tasks involve in each phases. (4 marks)
- (b) Based on the information given in Table **Q1**, perform the following:
- (i) Develop an Arrow Diagram Network (ADM) for the project and perform the Critical Path Method (CPM) calculation to determine the as soon as possible (A.S.A.P) duration and as late as possible (A.L.A.P) duration for all activities. Show the critical activities in your network. (6 marks)
 - (ii) Calculate the cost-slope for each activity and generate the project crash durations if crashing program is to be implemented to all critical activities. (10 marks)
 - (iii) Indirect cost for this project is RM 120 per day. As a project manager, you need to make a decision on the most economic overall project duration for your crashing program based on your answer in **Q1 (b) (ii)**. Show your crash curve to illustrate the cost-time relationship. (4 marks)



- Q2** (a) Briefly explain **SIX (6)** requirements that needs to be fulfilled when developing the Work Breakdown Structure (WBS) for a project. (6 marks)
- (b) Your company has outsourced the masonry works to a sub-contractor to build an exterior wall from 215mm clay brick (face dimension including mortar joint = 225 mm x 75mm). The wall is 24.6 meter long and 2.4 meter height. According to the contract, the sub contractor must finish the wall in 5 days and get paid RM1.50 per nos. of brick installed. At the end of day-1, the sub-contractor has installed 500 bricks and gets paid (including overhead and profit) amounting RM1500.
- (i) Based on above situation, as a Project Manager you need to analyse the situation with regard to both budget and the schedule. (15 marks)
- (ii) In your opinion will the sub-contractor finish the job on time, and within budget or the job will be facing overruns in both (cost and schedule)? Justify your answer. (4 marks)
- Q3** (a) Construction workers can be classified into two groups namely supervisors and labors. In general, the labors comprise of 90 percent to 95 percent of the total construction workers. List **FIVE (5)** main problems associated with the manpower resources in the construction sector. (5 marks)
- (b) (i) Table **Q3** shows data for a real project. If there are only 10 labors is available at any time, plan your resource for the project using the most suitable method. (15 marks)
- (ii) Using the same data provided in Table **Q3**, develop the Physical S-Curve for the project based on assumption that one (1) working day is equivalent to one (1) work for each activity. (5 marks)

- Q4** (a) Explain why does PERT requires to set three durations, i.e. Optimistic Duration, Most Likely Duration and Pessimistic Duration (T_o , T_m and T_p) to constitute the practical range of the duration for each activity. (5 marks)
- (b) (i) Draw the Precedence Network Diagram (PDM) for the project as shown in Table **Q4** and perform the Critical Path Method (CPM) calculation on the basis of the most likely durations. (5 marks)
- (iii) From the PDM network created in Q4 (b) (i), pick the longest three (3) paths and calculate the expected duration and standard deviation for each path. Considering all three paths, what is the duration of the project with at least 90% confidence level? (Refer Table Z in the attachment for the probability value) (15 marks)

-END OF QUESTIONS-

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Table Q1: Data for Project A Construction

| Activity | IPA | Duration (days) | | Cost (RM) | |
|----------|-----|-----------------|-------|-----------|-------|
| | | Normal | Crash | Normal | Crash |
| A | - | 5 | 4 | 770 | 900 |
| B | - | 3 | 2 | 660 | 700 |
| C | A | 7 | 4 | 800 | 1070 |
| D | A,B | 4 | 3 | 1000 | 1110 |
| E | B | 6 | 4 | 800 | 920 |
| F | C,D | 6 | 5 | 560 | 630 |
| G | D | 5 | 3 | 700 | 810 |
| H | F | 8 | 4 | 1000 | 1260 |
| I | E,G | 4 | 3 | 500 | 580 |
| J | H,I | 3 | 2 | 400 | 600 |

Table Q3: Data for a Single-Storey Building Project

| Activity | Activity Description | Duration (Days) | IPA | Relationship | Laborers |
|----------|-------------------------|-----------------|-------|--------------|----------|
| A | Excavation & Foundation | 6 | - | | 4 |
| B | SOG | 3 | A | | 3 |
| C | Framing | 10 | B | | 4 |
| D | Plumbing | 4 | B | | 2 |
| E | Electrical Wiring | 3 | C | SS | 3 |
| F | Drywall | 5 | C | SS | 3 |
| G | HVAC rough-in | 3 | C | SS | 4 |
| H | Roof | 5 | C | | 3 |
| I | Paint | 4 | F | | 2 |
| J | HVAC finish | 2 | G,H | | 2 |
| K | Flooring | 4 | D,I | | 3 |
| L | Electrical Finish | 1 | E,H | | 2 |
| M | Punch List & Cleanup | 1 | J,K,L | | 2 |

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Table Q4: Project Data for Project B Construction

| Activity | IPA | Duration (Days) | | |
|----------|-------|-----------------|-------------------|------------------|
| | | Optimistic (To) | Most Likely (Tm') | Pessimistic (Tp) |
| A | - | 4 | 6 | 11 |
| B | - | 3 | 4 | 6 |
| C | - | 6 | 9 | 15 |
| D | A,B | 3 | 4 | 11 |
| E | B | 5 | 7 | 10 |
| F | D | 4 | 5 | 8 |
| G | D,E | 7 | 10 | 16 |
| H | C,F,G | 6 | 8 | 10 |
| I | C,G | 3 | 3 | 5 |
| J | H,I | 2 | 2 | 2 |

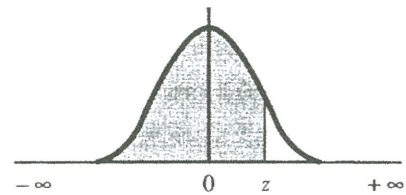
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Table Z: Cumulative Probability of the Standard Normal Distribution

CUMULATIVE PROBABILITIES OF
 THE NORMAL DISTRIBUTION (AREAS UNDER THE
 STANDARDIZED NORMALIZED CURVE FROM $-\infty$ TO z)



| z | 0.00 | 0.01 | 0.02 | 0.03 | 0.04 | 0.05 | 0.06 | 0.07 | 0.08 | 0.09 |
|-----|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| 0.0 | 0.5000 | 0.5040 | 0.5080 | 0.5120 | 0.5160 | 0.5199 | 0.5239 | 0.5279 | 0.5319 | 0.5359 |
| 0.1 | 0.5389 | 0.5438 | 0.5478 | 0.5517 | 0.5557 | 0.5596 | 0.5636 | 0.5675 | 0.5714 | 0.5753 |
| 0.2 | 0.5793 | 0.5832 | 0.5871 | 0.5910 | 0.5948 | 0.5987 | 0.6026 | 0.6064 | 0.6103 | 0.6141 |
| 0.3 | 0.6179 | 0.6217 | 0.6255 | 0.6293 | 0.6331 | 0.6368 | 0.6406 | 0.6443 | 0.6480 | 0.6517 |
| 0.4 | 0.6554 | 0.6591 | 0.6628 | 0.6664 | 0.6700 | 0.6736 | 0.6772 | 0.6808 | 0.6844 | 0.6879 |
| 0.5 | 0.6915 | 0.6950 | 0.6985 | 0.7019 | 0.7054 | 0.7088 | 0.7123 | 0.7157 | 0.7190 | 0.7224 |
| 0.6 | 0.7257 | 0.7291 | 0.7324 | 0.7357 | 0.7389 | 0.7422 | 0.7454 | 0.7486 | 0.7517 | 0.7549 |
| 0.7 | 0.7580 | 0.7611 | 0.7642 | 0.7673 | 0.7704 | 0.7734 | 0.7764 | 0.7794 | 0.7823 | 0.7852 |
| 0.8 | 0.7881 | 0.7910 | 0.7939 | 0.7967 | 0.7995 | 0.8023 | 0.8051 | 0.8078 | 0.8106 | 0.8133 |
| 0.9 | 0.8159 | 0.8186 | 0.8212 | 0.8238 | 0.8264 | 0.8289 | 0.8315 | 0.8340 | 0.8365 | 0.8389 |
| 1.0 | 0.8413 | 0.8438 | 0.8461 | 0.8485 | 0.8508 | 0.8531 | 0.8554 | 0.8577 | 0.8599 | 0.8621 |
| 1.1 | 0.8643 | 0.8665 | 0.8686 | 0.8708 | 0.8729 | 0.8749 | 0.8770 | 0.8790 | 0.8810 | 0.8830 |
| 1.2 | 0.8849 | 0.8869 | 0.8888 | 0.8907 | 0.8925 | 0.8944 | 0.8962 | 0.8980 | 0.8997 | 0.9015 |
| 1.3 | 0.9032 | 0.9049 | 0.9066 | 0.9082 | 0.9099 | 0.9115 | 0.9131 | 0.9147 | 0.9162 | 0.9177 |
| 1.4 | 0.9192 | 0.9207 | 0.9222 | 0.9236 | 0.9251 | 0.9265 | 0.9279 | 0.9292 | 0.9306 | 0.9319 |
| 1.5 | 0.9332 | 0.9345 | 0.9357 | 0.9370 | 0.9382 | 0.9394 | 0.9406 | 0.9418 | 0.9429 | 0.9441 |
| 1.6 | 0.9452 | 0.9463 | 0.9474 | 0.9484 | 0.9495 | 0.9505 | 0.9515 | 0.9525 | 0.9535 | 0.9545 |
| 1.7 | 0.9554 | 0.9564 | 0.9573 | 0.9582 | 0.9591 | 0.9599 | 0.9608 | 0.9616 | 0.9625 | 0.9633 |
| 1.8 | 0.9641 | 0.9649 | 0.9656 | 0.9664 | 0.9671 | 0.9678 | 0.9686 | 0.9693 | 0.9699 | 0.9706 |
| 1.9 | 0.9713 | 0.9719 | 0.9726 | 0.9732 | 0.9738 | 0.9744 | 0.9750 | 0.9756 | 0.9761 | 0.9767 |
| 2.0 | 0.9772 | 0.9778 | 0.9783 | 0.9788 | 0.9793 | 0.9798 | 0.9803 | 0.9808 | 0.9812 | 0.9817 |
| 2.1 | 0.9821 | 0.9826 | 0.9830 | 0.9834 | 0.9838 | 0.9842 | 0.9846 | 0.9850 | 0.9854 | 0.9857 |
| 2.2 | 0.9861 | 0.9864 | 0.9868 | 0.9871 | 0.9875 | 0.9878 | 0.9881 | 0.9884 | 0.9887 | 0.9890 |
| 2.3 | 0.9893 | 0.9896 | 0.9898 | 0.9901 | 0.9904 | 0.9906 | 0.9909 | 0.9911 | 0.9913 | 0.9916 |
| 2.4 | 0.9918 | 0.9920 | 0.9922 | 0.9925 | 0.9927 | 0.9929 | 0.9931 | 0.9932 | 0.9934 | 0.9936 |
| 2.5 | 0.9938 | 0.9940 | 0.9941 | 0.9943 | 0.9945 | 0.9946 | 0.9948 | 0.9949 | 0.9951 | 0.9952 |
| 2.6 | 0.9953 | 0.9955 | 0.9956 | 0.9957 | 0.9959 | 0.9960 | 0.9961 | 0.9962 | 0.9963 | 0.9964 |
| 2.7 | 0.9965 | 0.9966 | 0.9967 | 0.9968 | 0.9969 | 0.9970 | 0.9971 | 0.9972 | 0.9973 | 0.9974 |
| 2.8 | 0.9974 | 0.9975 | 0.9976 | 0.9977 | 0.9977 | 0.9978 | 0.9979 | 0.9979 | 0.9980 | 0.9981 |
| 2.9 | 0.9981 | 0.9982 | 0.9982 | 0.9983 | 0.9984 | 0.9984 | 0.9985 | 0.9985 | 0.9986 | 0.9986 |
| 3.0 | 0.9987 | 0.9987 | 0.9987 | 0.9988 | 0.9988 | 0.9989 | 0.9989 | 0.9989 | 0.9990 | 0.9990 |
| 3.1 | 0.9990 | 0.9991 | 0.9991 | 0.9991 | 0.9992 | 0.9992 | 0.9992 | 0.9992 | 0.9993 | 0.9993 |
| 3.2 | 0.9993 | 0.9993 | 0.9994 | 0.9994 | 0.9994 | 0.9994 | 0.9994 | 0.9995 | 0.9995 | 0.9995 |
| 3.3 | 0.9995 | 0.9995 | 0.9995 | 0.9996 | 0.9996 | 0.9996 | 0.9996 | 0.9996 | 0.9996 | 0.9997 |