

Software Engineering

Tutorial -1 SET2 – Answer Key

(Requirements Analysis and Modeling)

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Chocoholics Anonymous (Case study adapted from Schach)

Chocoholics Anonymous (ChocAn) is an organization dedicated to helping people addicted to chocolate in all its glorious forms. Members pay a monthly fee to ChocAn. For this fee they are entitled to unlimited consultations and treatments with health care professionals, namely, dietitians, internists, and exercise experts. Every member is given a plastic card embossed with the member's name and a nine-digit member number and incorporating a magnetic strip on which that information is encoded. Each health care professional (*provider*) who provides services to ChocAn members has a specially designed ChocAn computer terminal, similar to a credit card device in a shop. When a provider's terminal is switched on, the provider is asked to enter his or her provider number.

To receive health care services from ChocAn, the member hands his or her card to the provider, who slides the card through the card reader on the terminal. The terminal then dials the ChocAn Data Center, and the ChocAn Data Center computer verifies the member number. If the number is valid, the word Validated appears on the one-line display. If the number is not valid, the reason is displayed, such as Invalid number or Member suspended; the latter message indicates that fees are owed (that is, the member has not paid membership fees for at least a month) and member status has been set to suspended.

To bill ChocAn after a health care service has been provided to the member, the provider again passes the card through the card reader or keys in the member number. When the word Validated appears, the provider keys in the date the service was provided in the format MM-DD-YYYY. The date of service is needed because hardware or other difficulties may have prevented the provider from billing ChocAn immediately after providing the service. Next, the provider uses the Provider Directory to look up the appropriate six-digit service code corresponding to the service provided. For example, 598470 is the code for a session with a dietitian, whereas 883948 is the code for an aerobics exercise session. The provider then keys in the service code. To check that the service code has been correctly looked up and keyed in, the software product then displays the name of the service corresponding to the code (up to 20 characters) and asks the provider to verify that this is indeed the service that was provided. If the provider has entered a

nonexistent code, an error message is printed. The provider also can enter comments about the service provided.

The software product now writes a record to disk that includes the following fields:

- Current date and time (MM-DD-YYYY HH:MM:SS).

- Date service was provided (MM-DD-YYYY).

- Provider number (9 digits).

- Member number (9 digits).

- Service code (6 digits).

- Comments (100 characters) (optional).

The software product next looks up the fee to be paid for that service and displays it on the provider's terminal. For verification purposes, the provider has a form on which to enter the current date and time, the date the service was provided, member name and number, service code, and fee to be paid. At the end of the week, the provider totals the fees to verify the amount to be paid to that provider by ChocAn for that week.

At any time, a provider can request the software product for a Provider Directory, an alphabetically ordered list of service names and corresponding service codes and fees. The Provider Directory is sent to the provider as an e-mail attachment.

At midnight on Friday, the main accounting procedure is run at the ChocAn Data Center. It reads the week's file of services provided and prints a number of reports. Each report also can be run individually at the request of a ChocAn manager at any time during the week.

Each member who has consulted a ChocAn provider during that week receives a list of services provided to that member, sorted in order of service date. The report, which is also sent as an e-mail attachment, includes:

- Member name (25 characters).

- Member number (9 digits).

- Member street address (25 characters).

- Member city (14 characters).

- Member state (2 letters).

- Member ZIP code (5 digits).

For each service provided, the following details are required:

- Date of service (MM-DD-YYYY).

- Provider name (25 characters).

- Service name (20 characters).

Each provider who has billed ChocAn during that week receives a report, sent as an e-mail attachment, containing the list of services he or she provided to ChocAn members. To simplify the task of verification, the report contains the same information as that entered on the provider's form, in the order that the data were received by the computer. At the end of the report is a summary including

the number of consultations with members and the total fee for that week. That is, the fields of the report include:

- Provider name (25 characters).
- Provider number (9 digits).
- Provider street address (25 characters).
- Provider city (14 characters).
- Provider state (2 letters).
- Provider ZIP code (5 digits).

For each service provided, the following details are required:

- Date of service (MM-DD-YYYY).
- Date and time data were received by the computer (MM-DD-YYYY HH:MM:SS).
- Member name (25 characters).
- Member number (9 digits).
- Service code (6 digits).
- Fee to be paid (up to \$999.99).
- Total number of consultations with members (3 digits).
- Total fee for week (up to \$99,999.99).

A record consisting of electronic funds transfer (EFT) data is then written to a disk; banking computers will later ensure that each provider's bank account is credited with the appropriate amount.

A summary report is given to the manager for accounts payable. The report lists every provider to be paid that week, the number of consultations each had, and his or her total fee for that week. Finally, the total number of providers who provided services, the total number of consultations, and the overall fee total are printed.

During the day, the software at the ChocAn Data Center is run in interactive mode to allow operators to add new members to ChocAn, to delete members who have resigned, and to update member records. Similarly, provider records are added, deleted, and updated.

The processing of payments of ChocAn membership fees has been contracted out to Acme Accounting Services, a third-party organization. Acme is responsible for financial procedures such as recording payments of membership fees, suspending members whose fees are overdue, and reinstating suspended members who have now paid what is owing. The Acme computer updates the relevant ChocAn Data Center computer membership records each evening at 9 P.M.

Your organization has been awarded the contract to write only the ChocAn data processing software; another organization will be responsible for the communications software, for designing the ChocAn provider's terminal, for the software needed by Acme Accounting Services, and for implementing the EFT component. The contract states that, at the acceptance test, the data from a

provider's terminal must be simulated by keyboard input and data to be transmitted to a provider's terminal display must appear on the screen. A manager's terminal must be simulated by the same keyboard and screen. Each member report must be written to its own file; the name of the file should begin with the member name, followed by the date of the report. The provider reports should be handled the same way. The Provider Directory must also be created as a file. None of the files should actually be sent as e-mail attachments. As for the EFT data, all that is required is that a file be set up containing the provider name, provider number, and the amount to be transferred.

1. Capture the requirements of Chocoholics Anonymous System and draw DFD.

To simplify the data flow diagram, it is drawn in three parts. Data stores and external agents are repeated, but there is only one instance of each process. The data flow diagrams appear in Figures (a), (b) and (c).

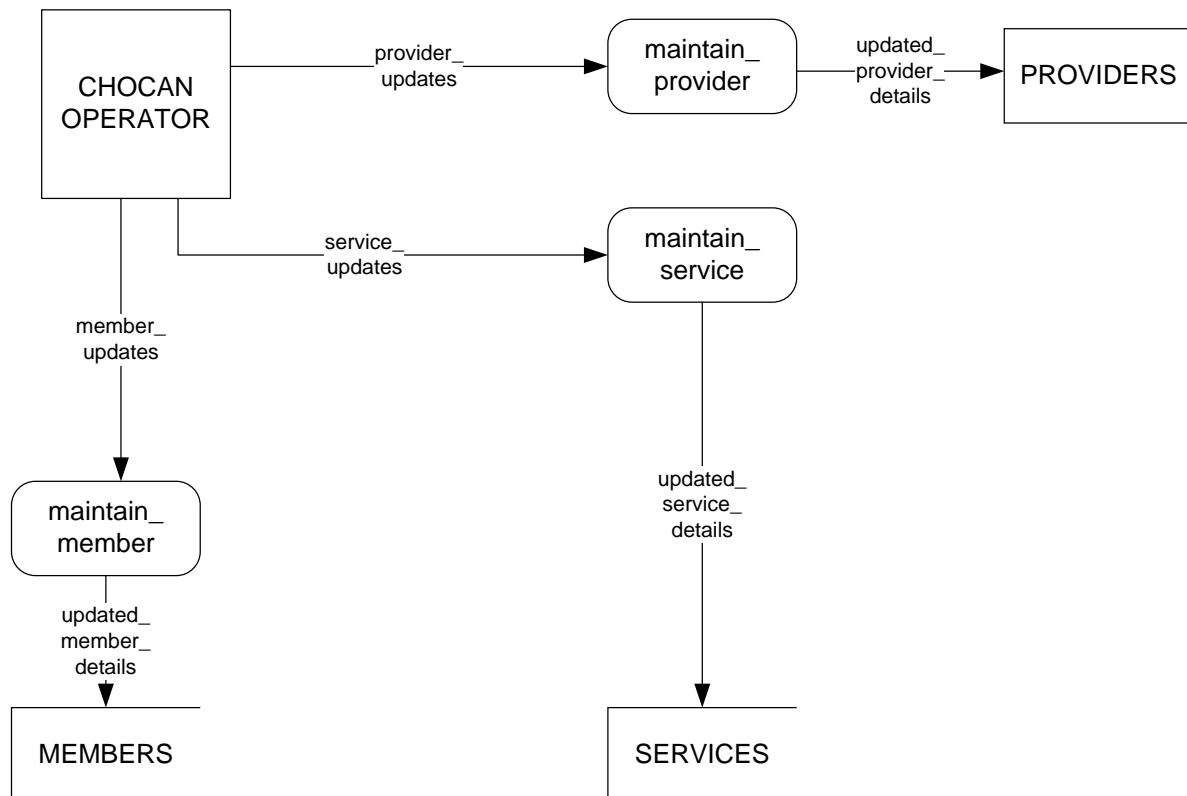


Figure (a). Part 1 of data flow diagram for Chocoholics Anonymous.

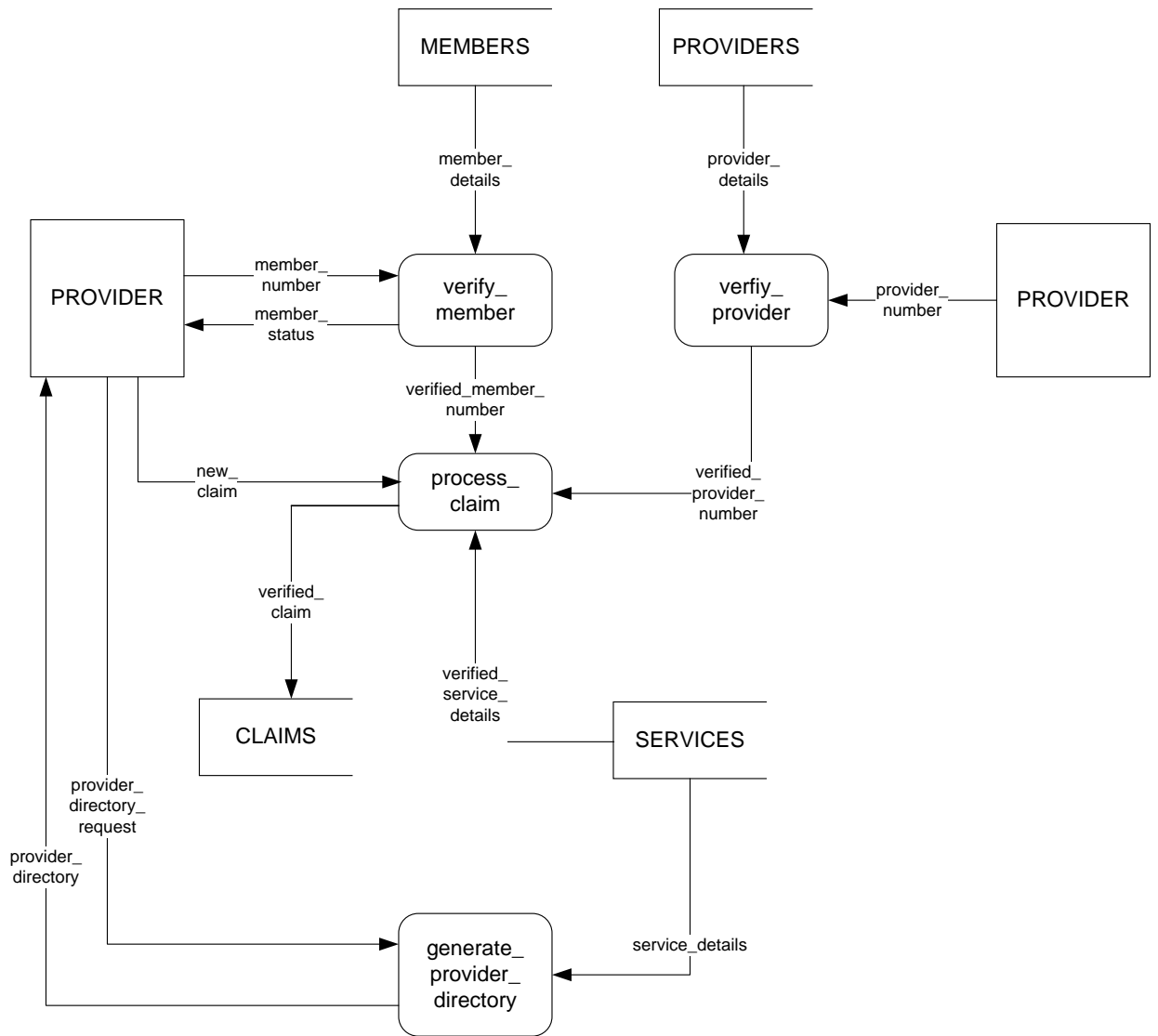


Figure (b). Part 2 of data flow diagram for Chocoholics Anonymous.

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graph TD
    PROVIDERS1[PROVIDERS] -- provider_details --> generate_EFT_data[generate_EFT_data]
    EFT_COMPONENT[EFT COMPONENT] -- EFT_data --> generate_EFT_data
    generate_EFT_data -- claim_details --> CLAIMS[CLAIMS]
    generate_EFT_data -- service_details --> SERVICES1[SERVICES]
    CHOCAN_MANAGER1[CHOCAN MANAGER] -- provider_report_request --> generate_provider_report[generate_provider_report]
    generate_provider_report -- provider_report --> CHOCAN_MANAGER1
    generate_provider_report -- service_details --> SERVICES1
    generate_provider_report -- claim_details --> CLAIMS
    generate_provider_report -- provider_report --> PROVIDER[PROVIDER]
    MEMBERS[MEMBERS] -- member_details --> generate_provider_report
    generate_provider_report -- member_details --> generate_member_report[generate_member_report]
    PROVIDERS2[PROVIDERS] -- provider_details --> generate_member_report
    generate_member_report -- member_report_request --> CHOCAN_MANAGER2[CHOCAN MANAGER]
    generate_member_report -- member_report --> MEMBER[MEMBER]
    generate_member_report -- service_details --> SERVICES2[SERVICES]
    CHOCAN_MANAGER2 -- accounts_payable_report_request --> generate_accounts_payable_report[generate_accounts_payable_report]
    generate_accounts_payable_report -- accounts_payable_report --> CHOCAN_MANAGER2
    generate_accounts_payable_report -- service_details --> SERVICES2
    generate_accounts_payable_report -- claim_details --> CLAIMS
    TIME[TIME: MIDNIGHT FRIDAYS] -.-> generate_EFT_data
    TIME -.-> generate_provider_report
    TIME -.-> generate_member_report
    TIME -.-> generate_accounts_payable_report

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All processes shown in the DFD will be computerized. A central database is required, installed on a server at the ChocAn Data Center. A client-server architecture is required for online implementation of the processes shown in Part 1 of the DFD (maintenance of the database by a ChocAn operator). The processes shown in Part 2 of the DFD will be implemented using provider terminals that interact with the server via a dial-up modem. The processes shown in Part 3 of the DFD will be implemented firstly as batch processes that will be run at midnight each Friday. This is indicated by the dashed lines (control flows) in the DFD. Secondly, a single report can be generated at any time interactively on request by the ChocAn manager from a client workstation.